COMPARATIVE STUDY OF POSTERIOR COMPONENT SEPARATION TECHNIQUE – TRANSVERSE ABDOMINIS RELEASE IN LARGE INCISIONAL HERNIAS WITH ONLAY MESH REPAIR

M.S. DEGREE EXAMINATION

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GOVT RAJAJI HOSPITAL

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CHENNAI, INDIA.

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled "**COMPARATIVE STUDY OF POSTERIOR COMPONENT SEPARATION TECHNIQUE – TRANSVERSE ABDOMINIS RELEASE IN LARGE INCISIONAL HERNIAS WITH ONLAY MESH REPAIR"** submitted by **Dr. M. SURESH KUMAR** to The Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the requirement for the award of M.S. Degree Branch I (General Surgery), is a bonafide research work carried out by him under my direct supervision & guidance.

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CERTIFICATE BY THE DEAN

This is to certify that the dissertation entitled "**COMPARATIVE STUDY OF POSTERIOR COMPONENT SEPARATION TECHNIQUE – TRANSVERSE ABDOMINIS RELEASE IN LARGE INCISIONAL HERNIAS WITH ONLAY MESH REPAIR"** is a bonafide research work done by **DR. M. SURESH KUMAR,** Post Graduate Student, Department of General Surgery, Madurai Medical College and Government Rajaji Hospital, Madurai, under the guidance and supervision of **Prof. DR. D. MARUTHUPANDIAN, M.S, FICS., FIAS,** Professor of General Surgery, Madurai Medical College and Government Rajaji Hospital, Madurai.

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DECLARATION

I, **Dr. M. SURESH KUMAR** declare that, I carried out this work on "**COMPARATIVE STUDY OF POSTERIOR COMPONENT SEPARATION TECHNIQUE – TRANSVERSE ABDOMINIS RELEASE IN LARGE INCISIONAL HERNIAS WITH ONLAY MESH REPAIR"** at the Department of General Surgery, Govt. Rajaji Hospital during the period of Oct 2016 – Sep 2018. I also declare that this bonafide work or a part of this work was not submitted by me or any others for any award, degree and diploma to any other University, Board either in India or abroad.

This is submitted to The Tamilnadu Dr.M.G.R.Medical University, Chennai in partial fulfilment of the rules and regulations for the M.S. degree examination in General Surgery.

Date: **Dr. M. SURESH KUMAR**

Place: Madurai

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And Last but not the least, I would like to thank my parents and The Almighty for being with me throughout the study providing moral support.

LIST OF ABBREVIATIONS

PCS-TAR	Posterior Component Separation – Transverse Abdominis Release
EO	External Oblique
IO	Internal Oblique
TA	Transverse Abdominis
ASIS	Anterior Superior Iliac Spine
CT	Computed Tomography
PPP	Progressive Preoperative Pneumoperitoneum
SSI	Surgical Site Infection
IAP	Intra Abdominal Pressure
IAH	Intra Abdominal Hypertension
CCS	Carolinas Comfort scale
QOL	Quality of Life
DM	Diabetes Mellitus
HTN	Hypertension

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INTRODUCTION

Large / Giant hernia has been defined arbitrarily in the literature as greater than a diameter of 10 to 15 cm or an area of 170 to 200cm^2. As the survival of complex trauma and abdominal catastrophe patients has been increased, the frequency and complexity of repairing the giant ventral defect have increased. Obesity and loss of domain makes additional challenges.

The ideal surgical approach to such difficult ventral hernia repair is still a matter of debate because of the high peri-operative morbidity (abdominal compartment syndrome,respiratory failure), frequent recurrences and poor quality of life. Closing such defects is a significant problem in obtaining a reliable, durable repair with low morbidity and recurrence rate. Open component separation technique comprising posterior component separation along with Transverse Abdominis Release (PCS-TAR) has overcome these difficulties.

POSTERIOR COMPONENT SEPARATION TECHNIQUE:

In 2012, Novitsky et al reported a novel approach to posterior component separation by transverse abdominis muscle release (TAR). The PCS-TAR is a modification of the Rives-Stoppa procedure which combines it with developing of a large retro-muscular/pre-peritoneal plane

and a consistent medial advancement of the abdominal wall musculature and accompanying fascia. By dividing the TA fibers, the lateral pull around the abdomen is released and the abdominal cavity is increased. The intra-abdominal pressure (IAP) is also lowered by drawing the abdominal wall upward. Also the force vector of the TA directly opposing the medialisation of the fascia is abolished. The result is a fascial advancement of 8 to 12 cm on each side which allows restoration without tension of the linea alba with improved abdominal core muscle function. Fascial closure rates of 91% for defects of 472 cm^2 with 50% reduction in wound morbidity were obtained in a recent study. Closure of the posterior rectus fascia and the large preperitoneal compartment avoids the use of expensive meshes and minimizes mesh-bowel interaction. Bi-laminar closure of the abdominal wall prevents mesh migration and protection against the infection. By working outside the rectus sheath the procedure avoids disruption of the neurovascular bundles that supply the antero-medial abdominal wall. Avoiding unnecessary extensive skin flaps and preservation of a significant portion of the abdominal wall blood supply improves healing and decreases wound morbidity.

AIMS AND OBJECTIVES:

This study aims at primarily finding the effect of Posterior component separation technique (PCS-TAR) in huge incisional hernias (defect >10cm) and comparing it with conventional Onlay mesh repair.

REVIEW OF LITERATURE

An incisional hernia occurs in an area of weakness caused by an incompletely-healed surgical wound. Since median incisions in the abdomen are frequent for abdominal exploratory surgery, ventral incisional hernias are termed ventral hernias. These can be among the most frustrating and difficult hernias to treat. Clinically, incisional hernias present as a bulge or protrusion at or near the area of a surgical incision.

Virtually any prior abdominal operation can develop an incisional hernia at the scar area (provided adequate healing does not occur), from large abdominal procedures (intestinal surgery, vascular surgery), to small incisions (appendix removal, or abdominal exploratory surgery). While these hernias can occur at any incision, they tend to occur more commonly along a straight line from the xiphoid process of the sternum straight down to the pubic bone, and are more complex in these regions. Hernias in this area have a high rate of recurrence if repaired via a simple suture technique under tension. For this reason, it is especially advised that these can be repaired via a tension free repair method using mesh.

***Incisional hernia*:** Abdominal surgery causes a flaw in the abdominal wall. This flaw can create an area of weakness in which a hernia may develop. This occurs after 2 to 10% of all abdominal surgeries, although some people are more at risk. Even after surgical repair, incisional hernias may return.

These hernias may occur after large surgeries such as intestinal or vascular surgery or after smaller surgeries such as an appendectomy or a laparoscopy, which typically requires a small incision at the umblicus. Incisional hernias themselves can be very small or large and complex, involving growth along the scar tissue of a large incision. They may develop months after the surgery or years after, usually because of inadequate healing or excessive pressure on an abdominal wall scar.

Anterior Abdominal Wall Anatomy

The anatomical layers of the abdominal wall include skin, subcutaneous tissue, superficial fascia, deep fascia, muscle, extraperitoneal fascia and peritoneum. This anatomy may vary with respect to the different topographic regions of the abdomen. The major source of structural integrity and strength of the abdominal wall is provided by the musculofascial layer. The main paired abdominal muscles include the external oblique muscles, internal oblique muscles, transverses abdominis muscles, and rectus abdominis muscles and their respective aponeuroses, which are interdigitated with each other and provide core strength and protection to the abdominal wall viscera. The integrity of the abdominal wall is essential not only to protect the visceral structures but also to stabilize the trunk and to aid trunk movement and posture. The Fascia below the skin - the superficial fascia is divided into a superficial fatty layer

- Camper’s fascia and a deeper fibrous layer - Scarpa’s fascia. The deep fascia lies on the abdominal muscles. Inferiorly Scarpa’s fascia blends with the deep fascia of the thigh. This arrangement forms a plane between Scarpa’s fascia and the deep abdominal fascia extending from the top of the thigh to the upper abdomen. Below the innermost layer of muscle, the transvere abdominis muscle, lies the transversalis fascia. The transversalis fascia is separated from the parietal peritoneum by a variable layer of fat, subcutaneous tissue.

Superficial Fascia:

The superficial fascia of the abdominal wall is divided into a superficial and a deep layer. It may be as thin as half an inch or less or as thick as 6 inches or more. Above the umbilicus, the superficial fascia consists of a single layer. Below the umbilicus, the fascia divides into two layers: the Camper fascia (a superficial fatty layer) and the Scarpa fascia (a deep membranous layer). The superficial epigastric neurovascular bundle is located between these two layers. The abdominal subcutaneous fat, which is separated by the Scarpa fascia, is highly variable in thickness.

Deep Fascia:

The deep fascia is a thin, tough layer that surrounds and is adherent to the underlying abdominal muscles. Each abdominal muscle has an

aponeurotic component that contributes to the deep fascia. The individual abdominal muscles are described below:

Subserous and Peritoneal Fascia:

The subserous fascia is also known as extraperitoneal fascia and serves to bond the peritoneum to the deep fascia of the abdominal wall or to the outer lining of the gastrointestinal tract. It may receive different names depending on its location (i.e. transversalis fascia when it is deep to that muscle, psoas fascia when it is next to that muscle, iliac fascia, and so on). The peritoneum is a thin (one cell thick) membrane that lines the abdominal cavity. It is useful in reconstructive efforts because it provides a layer between the bowel and mesh.

Rectus Abdominis And Rectus Sheath :

The rectus muscle extends from the xiphoid process of the sternum and 5, 6, 7th costal cartilages to the pubic symphysis and pubic crest. The muscle is enclosed within the rectus sheath formed by the aponeuroses of the lateral abdominal muscles. Along the length of this strap muscle there are three fibrous intersections separating the muscle into four segments. The fibrous intersections are attached to the anterior surface of the rectus sheath, but not to the posterior surface. This allows the superior and inferior epigastric vessels to pass along the posterior surface of the muscle without encountering a barrier. The most important feature from the surgical

perspective is that the fibers of the rectus sheath run from side-to-side. Vertical incisions divide fibers while horizontal incisions down closure with sutures encircling fibers rather that between fibers. The anterior rectus sheath is the union of the external oblique aponeurosis and the anterior layer of the internal oblique. The posterior rectus sheath is composed of the posterior layer of the internal oblique aponeurosis, the transverses abdominis aponeurosis, and the transversalis fascia. Superior to the costal margin, the posterior rectus sheath is absent because the internal oblique muscle is attached to the costal margin and the transvere abdominis courses internal to the costal cartilages The posterior rectus sheath has a similar trilaminar criss-cross pattern above the umbilicus, where it is composed of the posterior lamina of the internal oblique and the aponeurosis of the transverses abdominis muscle from either side.

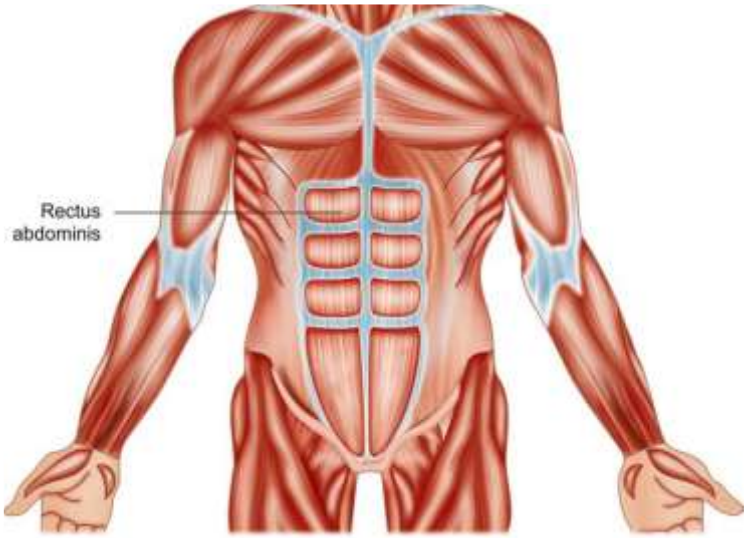


Fig.1: Rectus abdominis

Lateral Muscles:

The lateral muscles arise from the lower part of the rib cage, the lumbar fascia and the iliac crest. The external oblique muscle arises from the lower eight ribs. The fibers run downwards and forwards to form an aponeurosis anteriorly. The aponeurosis passes anteriorly to the rectus muscle to insert into the aponeurosis from the other side at the linea alba. Inferiorly the aponeurosis inserts into the anterosuperior iliac spine and stretches over to the pubic tubercle, forming the inguinal ligament. The internal oblique muscle arises from the lumbar fascia, the iliac crest and the lateral two-thirds of the inguinal ligament and runs upwards and forwards to form an aponeurosis. Above the arcuate line the aponeurosis splits to enclose the rectus muscle. Below the arcuate line the aponeurosis passes anterior to the rectus muscle. The inferior part of the aponeurosis inserts into the symphysis pubis. At this insertion the aponeurosis is fused with the aponeurosis of the transvere abdominis muscle to form the conjoint tendon. The transvere abdominis muscle arises from the lower six costal cartilages, the lumbar fascia and the iliac crest. The fibers run forwards to form an aponeurosis. Superiorly the aponeurosis passes behind the rectus muscle. Below the arcuate line the aponeurosis passes anterior to the muscle. The inferior fibers of the aponeurosis are fused with those of the internal oblique to form the conjoint tendon.

Musculofascial Layer:

The abdominal wall includes 5 paired muscles (3 flat muscles, 2 vertical muscles). The 3 flat muscles are the external oblique, internal oblique, and transverses abdominis. The 3-layered structure, combined with extensive aponeuroses, works in a synkinetic fashion not only to protect the abdominal viscera but also to increase abdominal pressure, which facilitates defecation, micturition, and parturition. The 2 vertical muscles are the rectus abdominis and pyramidalis. Fusion of the fascial layers of these muscles forms 3 distinct fascial lines: the linea alba and 2 semilunar lines. The linea alba is formed by the fusion of both rectus sheaths at the midline, while the semilunar lines are formed by the union of the external oblique, internal oblique, and transvere abdominis aponeuroses at the lateral border of the rectus abdominis muscle.

External Oblique (EO):

The external oblique muscle is the largest and thickest of the flat abdominal wall muscles. It originates from the lower 8 ribs, interlocks with slips of latissimus dorsi and serratus anterior, and courses inferior-medially, attaching via its aponeurosis centrally at the linea alba. Inferiorly, the external oblique aponeurosis folds back upon itself and forms the inguinal ligament between the anterior superior iliac spine and the pubic tubercle. Medial to the pubic tubercle, the external oblique aponeurosis is

attached to the pubic crest. Traveling superior to the medial part of the inguinal ligament, an opening in the aponeurosis forms the superficial inguinal ring. The innervation to the external oblique is derived from the lower 6 thoracic anterior primary rami and the first and second lumbar anterior primary rami.

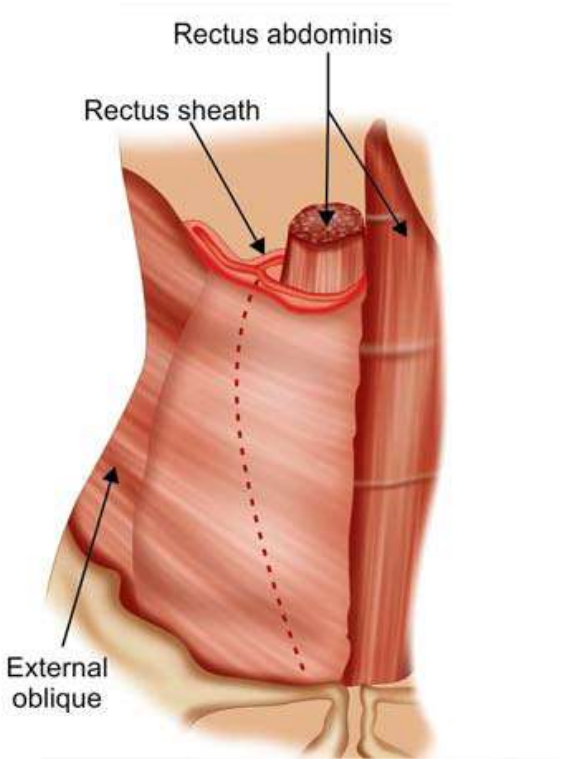


Fig.2 : External Oblique muscle

Internal Oblique (IO):

The internal oblique muscle originates from the anterior portion of the iliac crest, lateral half to two-thirds of the inguinal ligament, and posterior aponeurosis of the transvere abdominis muscle. The internal oblique fibers run superior-anteriorly at right angles to the external oblique

and insert on the cartilages of the lower 4 ribs. The anterior fibers become aponeurotic at around the ninth costal cartilage. At the lateral border of the rectus abdominis muscle and above the arcuate line, the aponeurosis splits anteriorly and posteriorly to enclose the rectus muscle to help form the rectus sheaths. However, beneath the arcuate line, the internal oblique aponeurosis does not split, resulting in an absent posterior rectus sheath. The inferior aponeurotic fibers arch over the spermatic cord, pass through the inguinal canal and then descend posterior to the superficial ring to attach to the pubic crest. The most inferior medial tendinous fibers fuse with the aponeurotic fibers of the transvere abdominis muscle to form the conjoint tendon, which also inserts on the pubic crest. The internal oblique is not invariable in its anatomy in the inguinal region. Its origin may commence at the internal ring or at a variable distance lateral to the ring. The muscle may then insert either into the pubic crest and tubercle or into the lateral margin of the rectus sheath a variable distance above the pubis. There are thus four combinations of origin and insertion of the internal oblique in the groin. The contribution of the internal oblique too groin anatomy and in particular to the defenses of inguinal canal is very variable. The internal oblique muscle in its lateral fleshy part is not uniform in its structure; it is segmented or banded. The muscular bands terminate just lateral to the border the rectus muscle and are most marked in the inguinal and lower abdominal region. The bands are generally arranged like the

“blades of a fan” with the interspaces increasing as the medial extremities are reached. Spigelian hernias occur through these defects of the semilunar line, which are more pronounced in the lower abdomen.

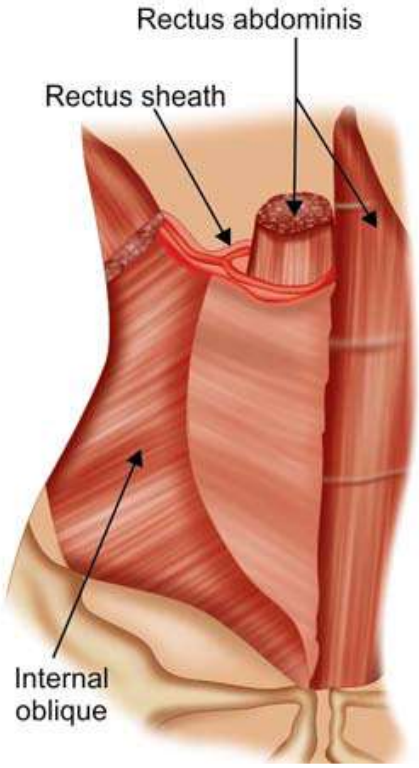


Fig.3: Internal Oblique muscle

Transvere Abdominis (TA):

The transvere abdominis muscle is the innermost of the 3 flat abdominal muscles. The fibers of the transverses abdominis course predominately in a horizontal orientation. It has 2 fleshy origins and 1 aponeurotic origin. The first fleshy origin is from the anterior threefourths of the iliac crest and lateral third of the inguinal ligament, while the second origin is from the inner surface of the lower 6 costal cartilages where they

interdigitate with fibers of the diaphragm. Between the 2 fleshy origins is the aponeurotic origin from the transverse processes of the lumbar vertebrae. These fibers course medially to the lateral border of the rectus muscle. From about 6.6 cm inferior to the xiphoid process to the arcuate line, the insertion is aponeurotic and contributes to the formation of the posterior rectus sheath.

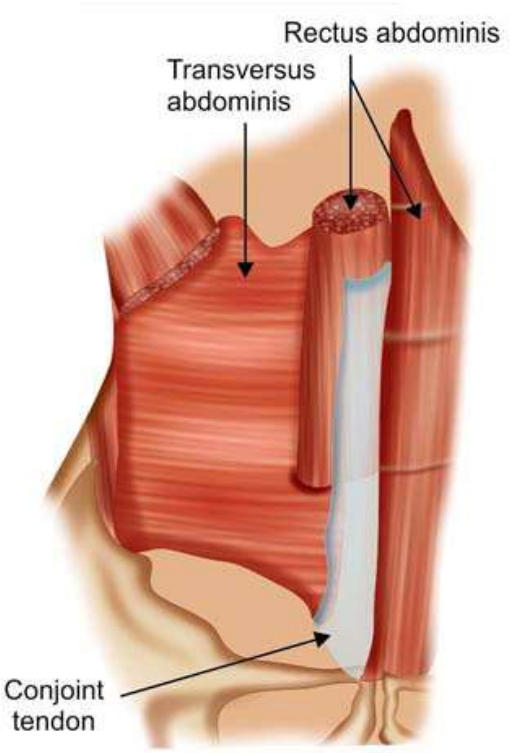


Fig.4: Transverse abdominis muscle

Fascia Transversalis:

The transversalis fascia (or transverse fascia) is a thin aponeurotic membrane which lies between the inner surface of the transvere abdominis and the extraperitoneal fascia. It forms part of the general layer of fascia lining the abdominal parietes and is directly continuous with the iliac and

pelvic fasciae. In the inguinal region, the transversalis fascia is thick and dense in structure and is joined by fibers from the aponeurosis of the transvere, but it becomes thin as it ascends to the diaphragm, and blends with the fascia Covering the under surface of this muscle.

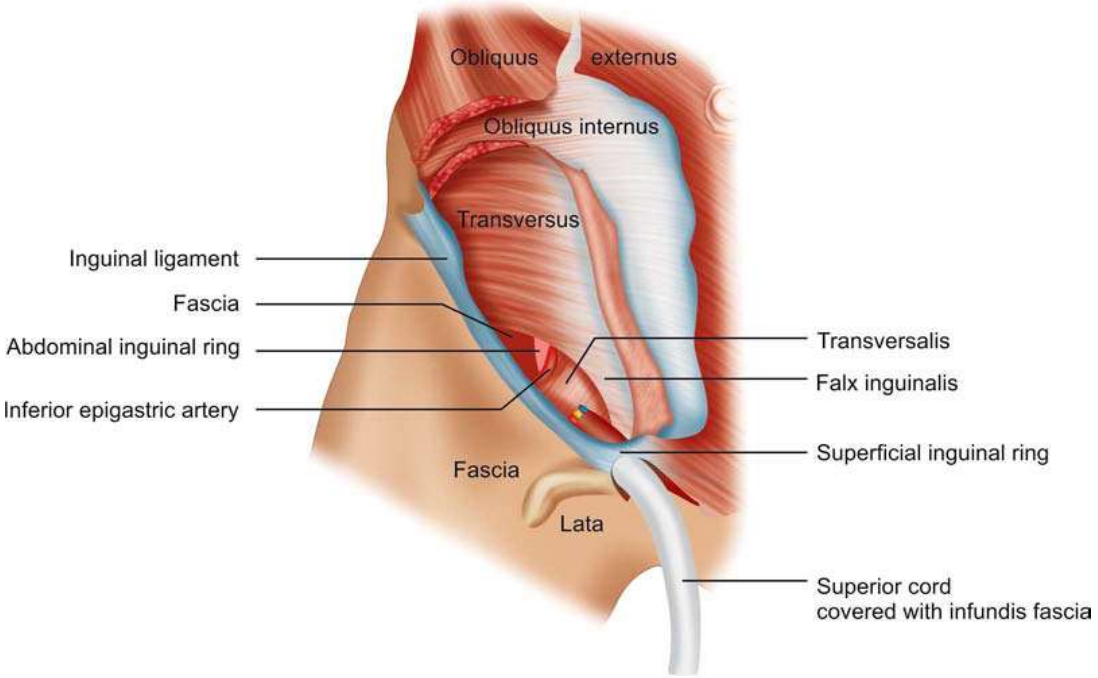


Fig.5: Anterior abdominal wall contents and extensions

Pyramidalis:

The pyramidalis is a small triangular muscle located anterior to the inferior aspect of the rectus abdominis; the pyramidalis is absent in about 20% of the population. The pyramidalis originates from the body of the pubis directly inferior to the insertion of the rectus abdominis and inserts into the linea alba inferior to the umbilicus to assist in stabilization of the lower midline.

Arcuate Line :

Above the arcuate line, the anterior rectus fascia exists anterior to the rectus muscle, and the posterior rectus fascia is posterior to the rectus muscle. Below the arcuate line, the 3 aponeuroses merge together to form exclusively the anterior rectus sheath, with little or no posterior sheath. The arcuate line is generally located 2 fingerbreadths from the umbilicus to midway between the umbilicus and pubis. However, some reports in the literature state that the arcuate line is closer to 75% of the distance between the pubic crest and the umbilicus or 1.8 cm superior to the anterior superior iliac spine (ASIS).

Linea Alba:

The linea alba is the fusion of the anterior and posterior rectus fascia; it is located in the abdominal midline, between the rectus muscles, from the xiphoid to the pubis. The linea alba is a 3-dimensional composition of tendon fibers from abdominal wall muscles. Midline insertions of these fibers play a significant role in stabilizing the abdominal wall. The cranial aspect is attached to the xiphoid process, while, caudally, it inserts at the pubic symphysis.

Linea Semilunaris:

The linea semilunaris can be seen as a pair of linear impressions in the skin that correspond with the most lateral edges of the rectus abdominis. These lines are visible in a person who is physically fit but obscured in a person who is obese. They are formed by the band of aponeuroses of the external oblique, the internal oblique, and the transvere abdominis muscles.

Vascular Supply and Innervation:

The plane between the internal oblique muscle and transvere abdominis muscle contains the neurovascular structures that supply the abdominal muscles. The superior and inferior deep epigastric vessels enter the rectus muscle superiorly and inferiorly. Transperitoneal vessels enter the rectus in the periumbilical region. The abdominal wall receives its blood supply from direct cutaneous vessels and musculocutaneous perforating vessels. The two subdivisions of perforators course medially and laterally. The lateral branch is usually the dominant branch and contains most of the perforator vessels. The lateral fasciocutaneous perforators pierce the aponeuroses of the internal and external oblique muscles. They may pass through the linea alba and emerge on the lateral aspect of the rectus abdominis.

Sensory innervation to the abdomen is derived from the roots of the nerves T7 to L4. These nerves travel in the plane between the internal oblique and transvere abdominis muscles. Motor innervation is provided by the intercostal, subcostal, iliohypogastric, and ilioinguinal nerves. These nerves must be preserved during abdominal wall reconstruction in order to maintain abdominal wall sensation and muscular function.

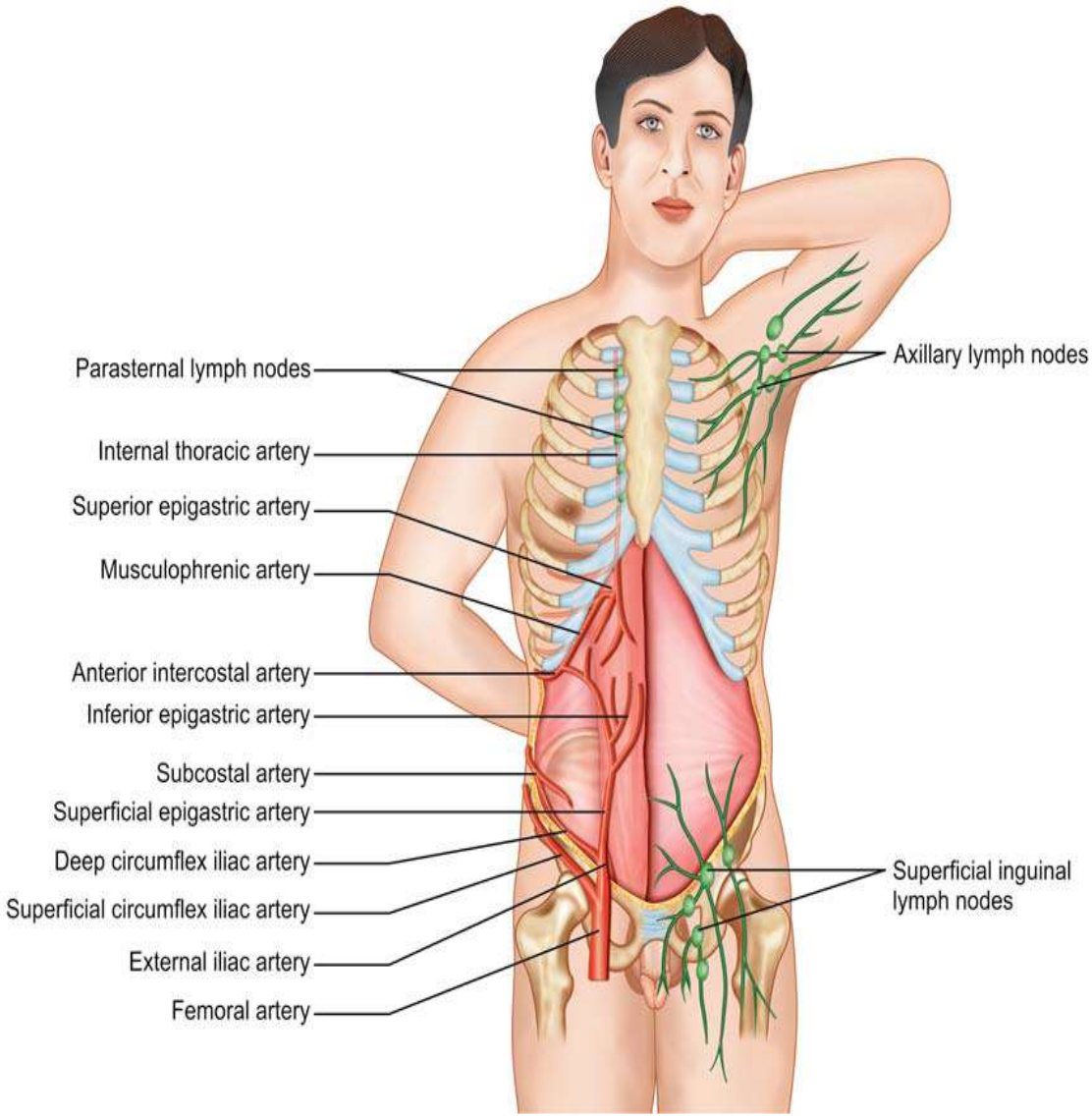


Fig.6: Vascular supply and innervations of anterior abdominal wall

Large incisional hernia:

Giant hernia has been defined arbitrarily in the literature as greater than a diameter of 10 to 15 cm or an area of 170 to 200 cm^2. As the survival of complex trauma and abdominal catastrophe patients has increased, the frequency and complexity of repairing the giant ventral defect have escalated. Obesity and loss of domain pose additional challenges.

Etiological Factors of Incisional Hernia:

The factors that increase the risk of incisional hernia are conditions that increase strain on the abdominal wall, such as obesity, advanced age, malnutrition, poor metabolism (digestion and assimilation of essential nutrients), pregnancy, dialysis, excess fluid retention, and either infection or hematoma after a prior surgery.

Tension created when sutures are used to close a surgical wound may also be responsible for developing an incisional hernia. Tension is known to influence poor healing conditions because of related swelling and wound separation. Tension and abdominal pressure are greater in people who are overweight, creating greater risk of developing incisional hernias following any abdominal surgery, including surgery for a prior inguinal (groin) hernia. People who have been treated with steroids or chemotherapy are also at greater risk for

developing incisional hernias because of the affect these drugs have on the healing process.

1. Sepsis is the main cause which occurs in post operative status giving rise to incisional hernia within first year of surgery.

2. Drainage tubes placement.

3. Repeated surgeries within 6 months.

4. Inflammatory bowel disease.

5. Early wound dehiscence.

6. Laparoscopic Surgery-Port sites.

7. Following specific surgeries on abdomen and pelvis cause incisional hernia in excess number of Patients:

- Hysterectomy
- Cholecystectomy and Biliary tract surgery
- Appendectomy
- Colorectal surgery
- Gastric operations
- Cesarean Surgery

8. Midline incisions taken are at high-risk developing hernia.

9. Lower midline incision have high-risk of developing hernia.

Indications/Contraindications

Loss of abdominal domain:

* There exists no consensus in the literature on the definition of loss of abdominal domain. Determination of this condition is subjective and typically refers to massive hernias with a significant amount of intestinal contents, which have herniated through the abdominal wall into a hernia sac, forming a secondary abdominal cavity.
* On physical examination, the inability to reduce the herniated contents below the level of the fascia when the patient is lying supine should raise suspicion of the diagnosis.
* Although the surgeon can often make the assumption that a patient has loss of domain on physical examination, we utilize computed tomography (CT) to determine the true nature of the hernia.

Measuring loss of domain:

* We arbitrarily define a loss of abdominal domain on CT scan as greater than 50% of the intestinal contents lying outside the native abdominal cavity in the hernia sac. This may be more accurately defined when the ratio of the volume of the hernia sac to the volume of the abdominal cavity is ≥ 0.5.
* A sagittal reconstruction of the CT scan is used to measure the length of the hernia sac from the top to the bottom of the sac. T he length of

the abdominal cavity is measured from the top of the diaphragm to the top of the symphysis pubis.

* Axial reconstructions are used to measure the width of the hernia sac and abdominal cavity at their widest point. T he height of the hernia sac is measured from an imaginary line drawn across the hernial orifice to the apex of the hernia sac at its tallest portion. The height of the abdominal cavity is measured from the anterior portion of the fourth lumbar space to an imaginary line drawn across the hernia orifice.

Physiology of hernias with loss of abdominal domain

* In patients with loss of abdominal domain the bowels reside outside the abdominal cavity. As intraabdominal pressure decreases to approach atmospheric pressure, abdominal viscera become edematous and their vasculature become engorged. This makes simple hernia reduction near impossible.
* Respiratory function is altered secondary to the loss of diaphragmatic support, and anterior spinal support fails leading to lordosis.
* The difficulty in repair of these hernias is that, not only are the herniated contents difficult to relocate back into the abdominal cavity, but doing so abruptly may result in postoperative physiologic collapse due to the creation of abdominal compartment syndrome.

There are no formal indications for abdominal wall reconstruction via component separation technique; however, there are a multitude of instances when this treatment modality for abdominal wall reconstruction should be considered. General consideration for employing this technique includes large midline hernias, infected wounds or those that have exposed mesh and patients who have failed prior herniorrhaphy. The number of failed attempts at herniorrhaphy directly correlates with likeliness of additional failures with conventional mesh techniques and approaches 50% after three repairs.

One of the benefits of this technique is that autologous tissues are used. Thus, in wounds such as those with attempts with synthetic mesh repair and exposure or active infection of the mesh is noted, component separation is a good option for reconstruction.

Most commonly this does not require the use of any synthetic or biologic mesh at all. Therefore, abdominal wall reconstruction can be undertaken in non-clean fields such as those with enterocutaneous fistulae or ostomy reversals. Some sources advocate for closure of fistulae, infection or reversal of ostomies in a preliminary procedure, and thus a staged fashion to prevent complications before undertaking definitive reconstruction. This proposed staged reconstruction would require intentionally leaving the patient with a hernia by either closing the skin only or placing a skin graft over granulated bowel or over a vascularized

bioprosthetic mesh. The use of synthetic mesh is a relative contraindication with patients classified as having contaminated or dirty wounds and should be avoided in herniorrhaphy requiring such and a biologic mesh should be considered.

The component separation technique medializes the rectus abdominis and in doing so provides highly vascularized, neuritized dynamic muscular support to the midline. It has been postulated that by restoring the dynamic support across the hernias, the intrinsic weakness of this area is distributed along the entirety of the abdominal wall. Muscular closure eliminates this focal point of weakness although mesh repair does not. With this philosophy, many experts advocate that any ventral hernia should be repaired with muscle.

Defect size is of debate as to the appropriate approach to repair and minimization of recurrence rate. Mathes advocates for defects greater than 40 cm2, while Shestak uses 6 cm as the arbitrary defect diameter for performing component separation. In a prospective analysis of sutured versus meshed repair of hernias greater or less than 10 cm, a failure rate of those hernias greater than 10 cm was 63% in the sutured group versus 32% in the meshed repair. The group with defects less than 10 cm the recurrences were greater than 17% with either repair. All modalities based upon Burger's analysis are of notable risk for recurrence based regardless of the size of the defect and arguably these patients may have lower

recurrence with a component separation reconstruction of the abdominal wall.

The professional consensus is that any patient who has failed prior repair, and especially multiply failed repairs, should be considered for component separation. Poor viability of midline tissues such as the fascia warrants medialization of high quality tissues and releases to minimize tension at the midline. This should be taken into consideration in patients with lesser quality tissues such as those that are immunocompromised, diabetic, or older individuals in attenuated tissues require the tension-free repair that component separation provides.

Absolute contraindication for undergoing a component separation are those patients who lack the anatomy to perform this technique such as those who have lost abdominal domain for conditions such as a pancreatic fistula or necrotizing soft tissue infections of the abdominal wall. Patients considered to be of perioperative risk from multiple comorbidities should be closely considered for undergoing component separation as there may be perioperative morbidity or mortality from underlying medical disease. Unless symptomatic, necessity of repair in these high risk patients must be carefully considered. Patients with pulmonary disease have risk of further exacerbating pulmonary compromise although this has not been published in the literature. The rationale for such is that upon reconstruction of the abdominal wall, the coelomic contents will be shifted into the thoracic

domain and affect lung capacity. Smokers are at increased risk for failure of repair. This is multifactorial in that the stresses to the abdominal wall caused when coughing increase rate of failure. Evidence-based medicine has shown that vasoconstrictive chemicals in tobacco are notably detrimental to the wound healing process. Radiated tissues have high rates of dehiscence and necrosis. In instances of radiation to the abdominal wall, to obtain successful reconstruction high-quality non-irradiated tissues should be delivered to the surgical site. This may involve pedicled or free flap reconstruction. Patients with a history of multiple prior abdominal procedures with varied approaches should be addressed with caution as surgical dissection in performing component separation may result in partial or total abdominal wall necrosis.

Abdominal Wall Reconstruction Techniques:

* Reconstruction techniques for hernias with loss of domain must focus first upon the ability to relocate the herniated contents back into the native abdominal cavity and secondly, the ability to re-pproximate the midline fascia overtop a retromuscular implanted prosthetic mesh.
* To re-accommodate such a large volume of herniated contents, the surgeon must employ a modality which increases the volume of the abdominal cavity. This can only occur by lengthening the abdominal wall musculature via either:

* Mechanical traction
* Anatomic alteration
* Synthetic replacement
* Combination of techniques

Mechanical Traction

Progressive preoperative pneumoperitoneum:

* Insufflation of the peritoneal cavity acts as an intraperitoneal pneumatic tissue expander and lengthens the abdominal wall musculature, increasing the volume of the abdominal cavity. This allows for adequate accommodation for the herniated contents and is our preferred preparatory technique.
* It also attenuates the adverse physiologic effects associated with ventral hernia repair in patients with a loss of abdominal domain, by slowly creating a chronic abdominal compartment syndrome. With decreased diaphragmatic excursion, the patient is forced to overcome the inherent decreased inspiratory capacity.
* In addition, the adverse cardiovascular effects of acute abdominal compartment syndrome are attenuated by the slow introduction of intraperitoneal air.

Laparostomy with progressive mesh excision:

* This technique employs a synthetic mesh sewn to the edges of the hernia defect as an inlay. Over multiple successive operations, a central portion of the mesh is excised, and the mesh re-sutured in the midline. This provides a slow and progressive mechanical traction on the midline fascia, allowing for eventual fascial re-approximation. Although effective, this technique is cumbersome, and requires multiple operations.

Tissue expanders:

* Synthetic tissue expanders can be placed between abdominal wall muscle layers and slowly expanded over the course of several weeks. The expander balloon lengthens the abdominal muscles by exerting a mechanical traction. This technique is preferred for skin expansion alone, when there is a concern over potential inadequate skin coverage during hernia repair.

Anatomic Alteration

Component separation:

* This technique provides an increase in abdominal circumference with the possibility of subsequent fascial closure by disconnecting musculofascial layers, which lengthen the overall abdominal wall musculature. We employ a unique posterior component separation

technique with retromuscular mesh reinforcement of the abdominal wall reconstruction.

Synthetic Replacement

Silo technique:

This technique is utilized for hernia defects so wide that no preparatory techniques or intraoperative maneuvers available would allow for native fascial re-approximation. These hernias require that a synthetic mesh span the entire defect and contain the herniated intestines like a silo, similar to the technique used for treatment of congenital abdominal wall deformities such as omphalocele and gastroschisis. The only difference here, being that the prosthetic is left *in situ* with skin and subcutaneous coverage alone. This is the least desirable of all the techniques; however, it may be the only option in select patients.

Preoperative Planning:

- **Physical examination**

The physical examination alone is often helpful in determining whether a patient has loss of domain. With the patient lying supine on the examination table, the surgeon should attempt to reduce the herniated

contents below the fascia. If the hernia does not reduce due to the amount of herniated contents, the patient likely has a component of loss of domain.

The abdominal wall should be examined for elasticity. Although some massive hernias may be irreducible, the patient's abdominal wall musculature may have such elasticity so as to accommodate the herniated contents easily at the time of surgery. This finding would obviate the need for any preparatory procedures such as progressive preoperative pneumoperitoneum, since a single stage repair may be feasible.

The quality of the skin should be examined to determine if any adjunctive maneuvers will be required to obtain safe skin closure at the time of hernia repair.

Widened thin scars, skin ulceration, thin subcutaneous tissue with tense and immobile skin, and large pannus flaps should all raise concern over skin closure. Consultation with a plastic surgeon may help to determine the need for preoperative tissue expanders, panniculectomy, or complex skin closure at the time of hernia repair.

- **Computed tomography (CT)**

As previously described, the volume of the hernia sac and abdominal cavity are calculated and compared. A volume ratio of the hernia sac to the abdominal cavity of ≥ 0.5 confirms loss of abdominal domain.

Other attributes of the abdominal wall should be examined on CT as they may help determine which adjunctive maneuvers will be required for hernia repair.

In our experience, patients with smaller defects and a significant amount of herniated contents benefit the most from progressive preoperative pneumoperitoneum.

Patients with round-shaped abdominal cavities on axial imaging and thick, robust rectus abdominis and oblique muscles may experience less muscle lengthening with preoperative pneumoperitoneum compared to those with a more ellipsoid appearance to the abdominal wall and thin atrophic musculature.

Patients with “open book” abdomens such as those with significant loss of abdominal wall substance (missing abdominal wall musculature) and hernia defects which span the entire abdominal wall may not benefit anatomically from preoperative pneumoperitoneum as there may not be enough abdominal wall musculature to stretch. The physiologic benefits may still be realized, however.

These patients may be best served by the silo technique.

- **Preoperative Risk Reduction:**

Due to the adverse effects of smoking and obesity on postoperative infection and wound complications, the patient must be counseled

regarding preoperative smoking cessation and weight loss. While it may be unrealistic to require significant weight loss, a reasonable goal may often be set with the patient through comprehensive counseling regarding dietary and behavioral changes and the adverse effect of obesity on surgical outcome.

Chronic skin conditions should be treated optimally prior to surgery to reduce the risk of infection. Eradication treatment should be implemented for patients with recurrent infections with methicillin-resistant *S. aureus.*

- **Perioperative analgesia:**
- Strong consideration should be given to the use of epidural anesthesia in the postoperative arena.
- The cardiac and pulmonary benefits of epidural anesthesia have been proven and in these patients, preservation of pulmonary function is often critical to their recovery.

Surgery

Our preferred approach to hernias with loss of domain is to prepare patients both physiologically and anatomically for the repair.

This is followed by the posterior component separation technique with retromuscular mesh placement.

Posterior Component Separation Technique:

Abdominal wall reconstruction

- Every effort should be made to ensure rectus abdominis re-approximation in the midline with ventral fascial closure overtop the mesh.
- Our preferred method for abdominal wall reconstruction in these patients is the posterior component separation (PCST).
- The posterior component separation technique allows for similar midline fascial re-approximation in large defects as compared to the anterior, Ramirez component separation.
- With the PCST, the transvere abdominis muscle (posterior) is disconnected from the internal and external obliques (anterior), which remain attached to the rectus muscle. By release of the posterior component, the anterior components can advance medially.

Rives–Stoppa with PCST

- After a complete lysis of adhesions a towel is placed intraperitoneally to protect the underlying viscera.
- The posterior rectus sheath is divided vertically 1 cm or less from the edge of the linea alba and the division continues 5 cm cephalad to the hernia defect edge and 5 cm caudal to it (Fig.7)

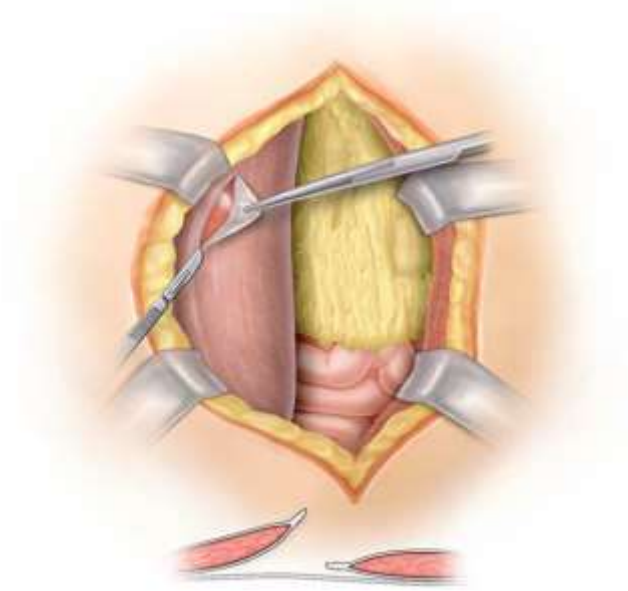


Fig.7 : Retromuscular hernia repair begins by entering the posterior rectus sheath 1 cm or less from the edge of the linea alba.

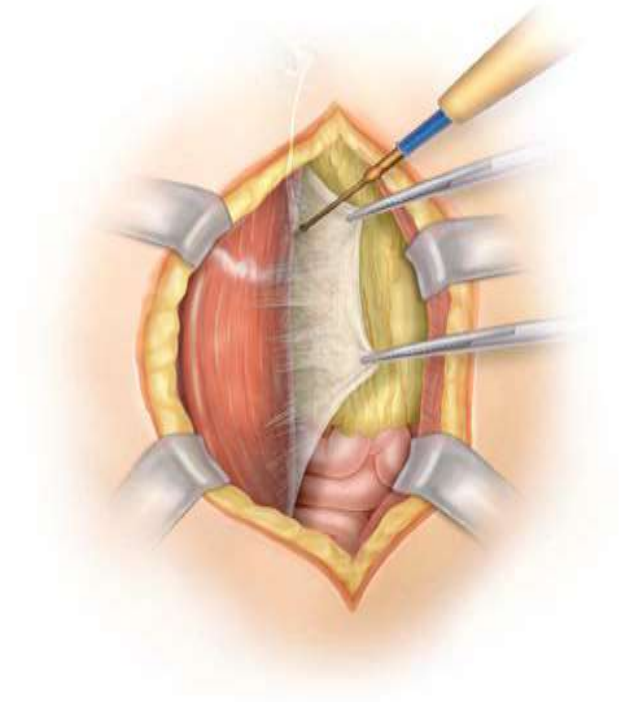


Fig.8: The posterior rectus sheath is reflected posteriorly under tension and the rectus muscle is gently dissected off the ventral aspect of the sheath.

- The posterior rectus sheath is reflected posteriorly under tension and the rectus muscle is gently dissected off the ventral aspect of the sheath (Fig.8).
- A similar dissection is performed on the contralateral side.
- The dissection is carried to the lateral most extent of the rectus sheath. With a Richardson retractor reflecting the rectus laterally at this lateral extent, a subtle ridge will become evident. This ridge is formed by the rolled over anterior leaf of the internal oblique aponeurosis as it fuses with the transverses abdominis aponeurosis to form the posterior rectus sheath
- By incising the fascia 1 to 2 mm medial to this ridge, the interparietal plane between internal oblique and transvere abdominis muscle will be accessed, and the incision is continued for the entire length of the skin incision and beyond (Fig.9).

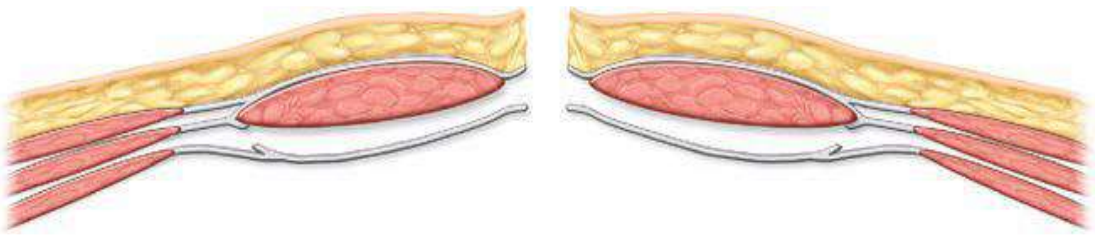


Fig.9: The fascia is incised 1 to 2 mm medial to the aforementioned ridge, gaining access to the interparietal plane between internal oblique and transverses abdominis muscle.

- Motor innervation of the rectus and oblique muscles is provided by the intercostal, sub-costal, iliohypogastric, and ilioinguinal nerves.
- The intercostal nerves of T 7 to L4 run between the transvere abdominis and internal oblique muscles, and enter the undersurface of the rectus abdominis muscle at the junction of its lateral and medial third. These nerves will be encountered during the PCST and are routinely divided should they interfere with wide mesh placement. In our experience, this has not led to any abdominal wall paralysis or denervation bulge.
- The interparietal plane is dissected far out laterally. This dissection disconnects the transvere abdominis muscle from the anterior components, allowing medial advancement of the posterior rectus sheath for complete peritoneal closure as well as medial rectus advancement for total abdominal wall reconstruction.
- PCST provides a well-vascularized and wide space for mesh placement with similar advancement to the Ramirez component separation without the need for a subcutaneous skin dissection and its attendant morbidity.
- The protective towel, which was placed intraperitoneally, is removed now and the posterior rectus sheath is re-approximated in the midline with a slow-absorbing monofilament suture.
- The synthetic mesh is placed in the retromuscular space and fixated with fullthickness permanent transabdominal sutures utilizing the

Reverdin needle (Fig.10).

- The anterior sheath is closed in the midline ventral to the mesh utilizing a slowabsorbing monofilament suture utilizing a 4:1 suture to wound length ratio.
- See Figure 11 to 17

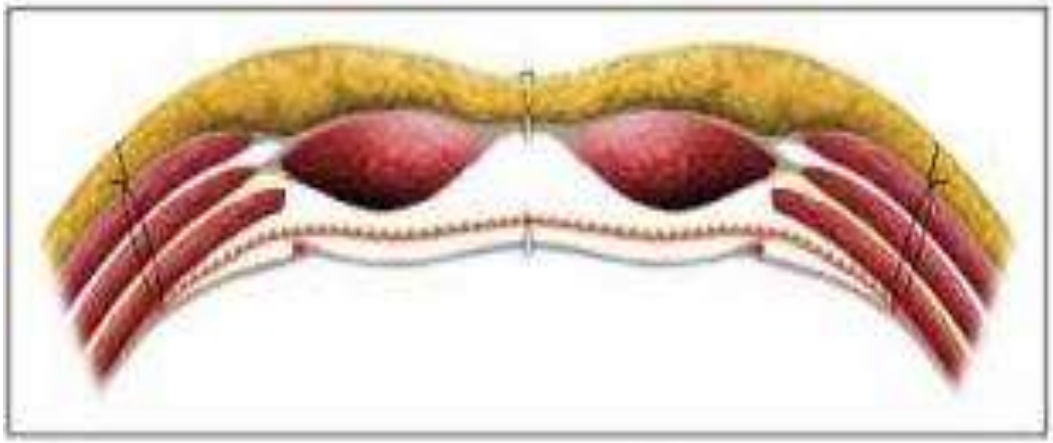


Fig.10: The Reverdin needle passing the suture through the full-thickness of the abdominal wall. To ensure medial rectus re-approximation, a traditional, anterior Ramirez component separation technique may be performed.

Fig.11: Huge incisional hernia

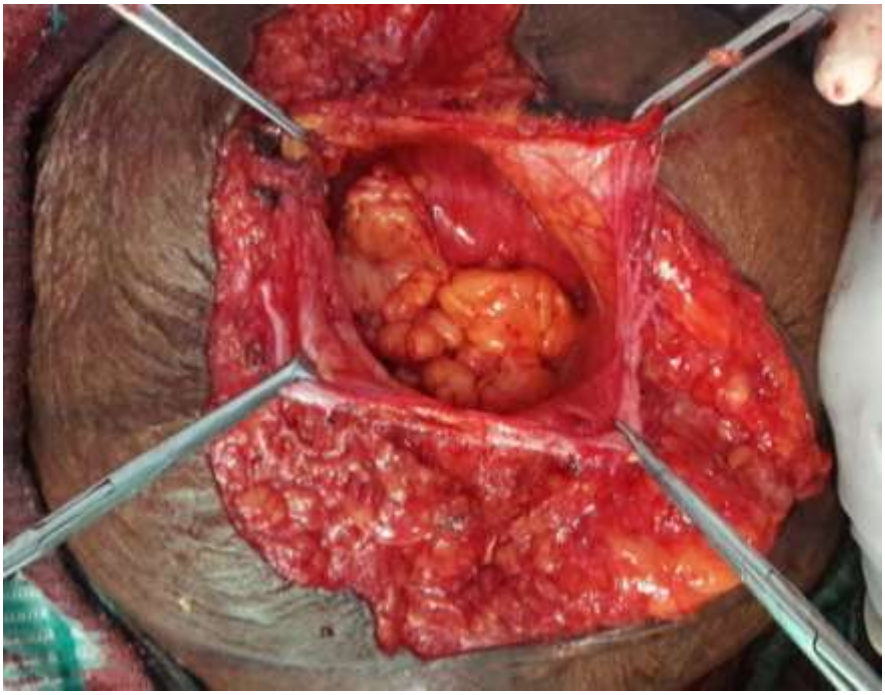


Fig.12: contents reduced; sac excised; defect of size 12*10cm

Fig.13: preservation of neurovascular bundle after creating a plane between rectus muscle and posterior sheath (medial to linea semilunaris)

Fig.14: Release of TA from its attachment to linea semilunaris

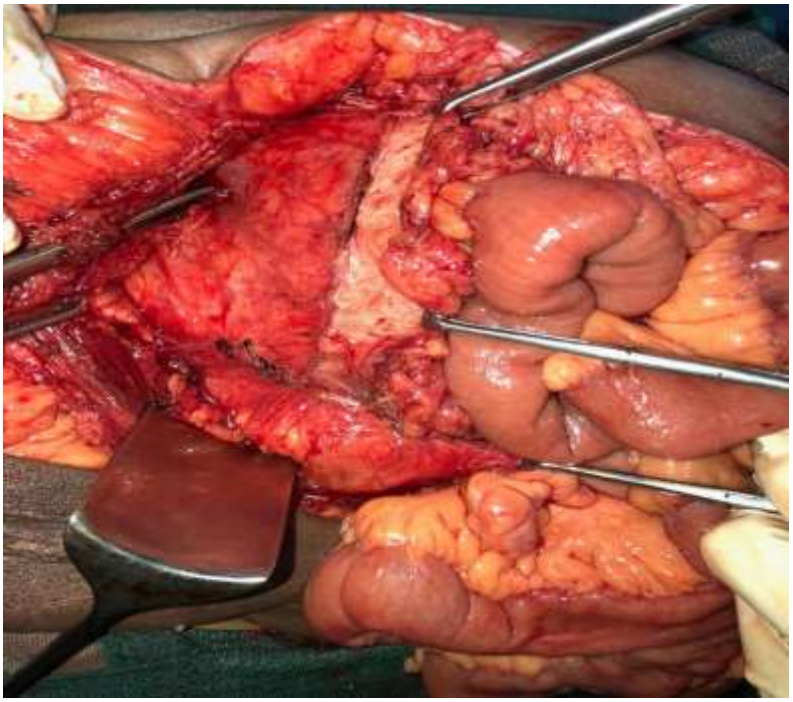


Fig.15: Creating plane for sublay mesh placement after releasing TA

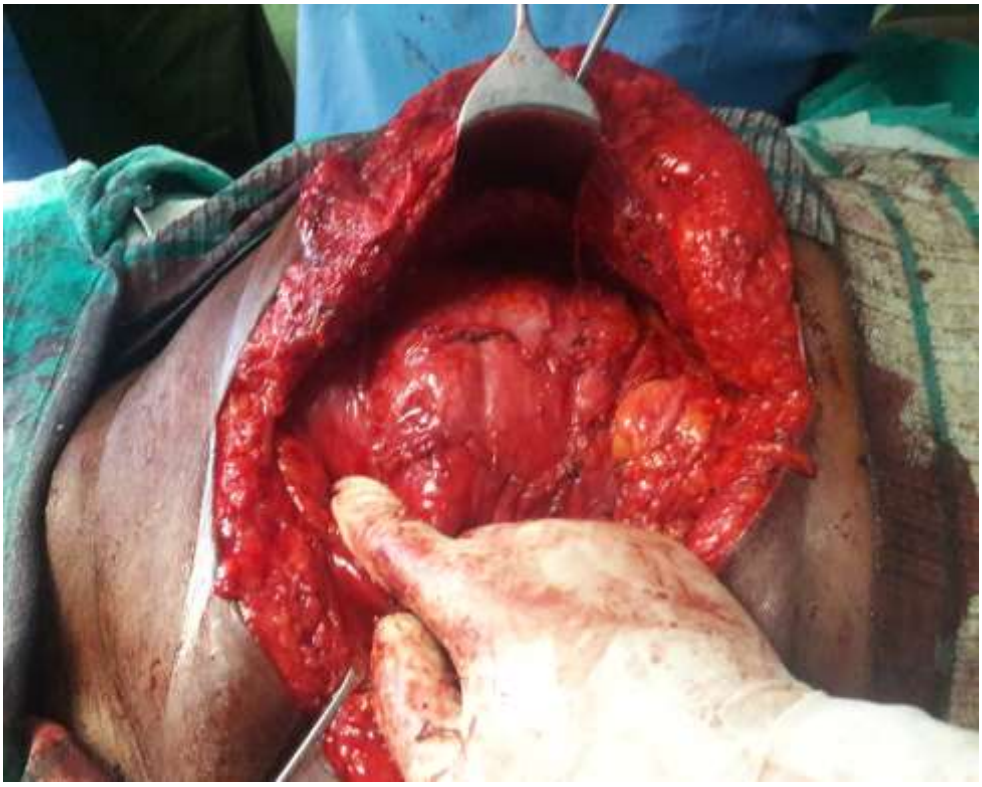


Fig.16: closure of posterior rectus sheath and a plane for mesh placement (sublay)

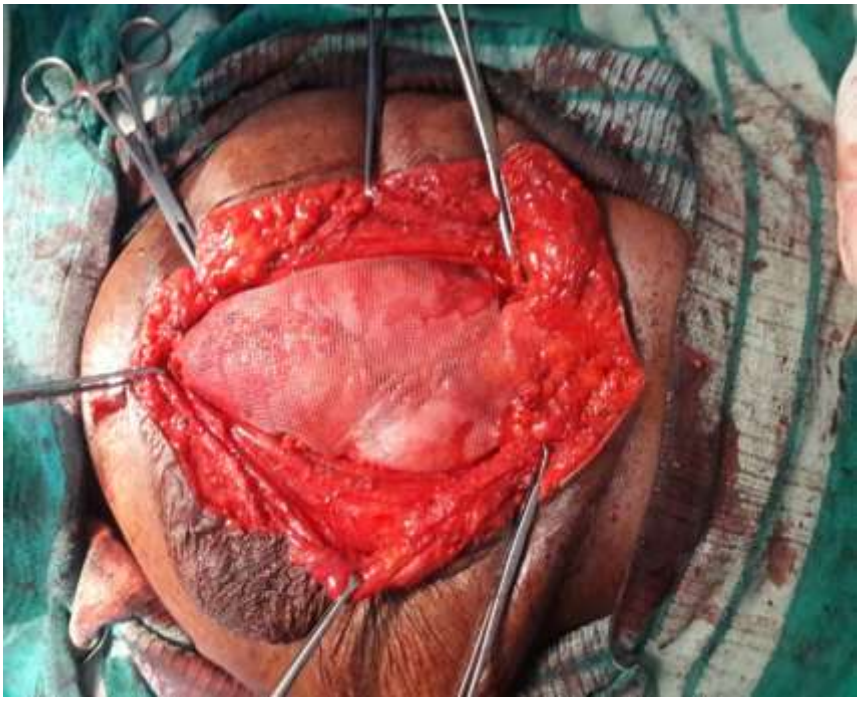


Fig.17: PCS-TAR and Mesh placement

Postoperative Management:

- Standard postoperative care is instituted in these patients with loss of domain. If there are concerns over elevated intraperitoneal pressures after abdominal wall closure, consideration may be given to maintaining endotracheal intubation with muscle paralysis for several days to allow the patient to recover.
- Standard thromboembolic chemoprophylaxis is resumed postoperatively.
- Supplemental oxygen therapy is administered as needed and incentive spirometry is strongly encouraged.

- Early ambulation is important, and a diet is begun as soon as the surgeon is comfortable doing so.

Complications:

- Postoperative ileus is common in these large hernia repairs. Vigilance to the patient's symptoms and abdominal distention helps to identify this complication early.
- A postoperative bowel obstruction, however, should raise the suspicion of an interparietal hernia, particularly after the retromuscular hernia repair. Here the posterior rectus sheath closure may have partially come apart allowing a loop of intestine to slip through the defect into the created space between the posterior rectus sheath and the mesh.
- Surgical site infection (SSI) is unfortunately more common in the repair of hernias with loss of domain than in other smaller defects.

We treat SSI very conservatively. Typically, washout with negative pressure wound therapy will allow prompt resolution of this problem. If the mesh becomes exposed in the wound, mesh removal is not recommended until a conservative trial of salvage has been attempted. In our experience, polytetrafluoroethylene and polyester-based mesh exposures often require complete or partial mesh removal.

Special Considerations:

Obesity

Most patients with massive hernias and loss of domain are obese. Every effort should be made to have the patient lose weight preoperatively. There is no standard rule, however, a weight loss of 20 to 30 lb can make a large difference in the ability to obtain fascial closure and complete abdominal wall reconstruction.

Contaminated Abdominal Wall

Patients with enteral or urinary stomas or enterocutaneous fistulas are candidates for progressive preoperative pneumoperitoneum. Attention should be paid to the stoma to ensure that ischemia does not develop during insufflation.

Patients with infected mesh and massive hernia with loss of domain pose a special problem. Although still candidates for preoperative pneumoperitoneum, serious consideration should be given to mesh removal and skin closure first followed by PPP at a second stage. An abdominal wall with infected mesh will be indurated and edematous; as a result, little muscle lengthening would occur with PPP. Additionally, mesh removal will undoubtedly damage some abdominal wall making the immediate reconstruction all the more difficult.

In our thesis, posterior component separation technique is compared with conventional onlay mesh repair which involves the placement of mesh over Anterior rectus sheath after reducing the contents and closure of midline.

ONLAY MESH REPAIR:

STEPS:

- Incision made over the defect, sac dissection done and contents are reduced.
- Anterior Rectus sheath is re-approximated with non-absorbable suture material.
- Flap raised between anterior rectus sheath and subcutaneous tissues of about 5cm all around the defect and prolene mesh is fixed onlay over the anterior rectus sheath.
- Drain placed over the mesh and subcutaneous tissue and skin closed.

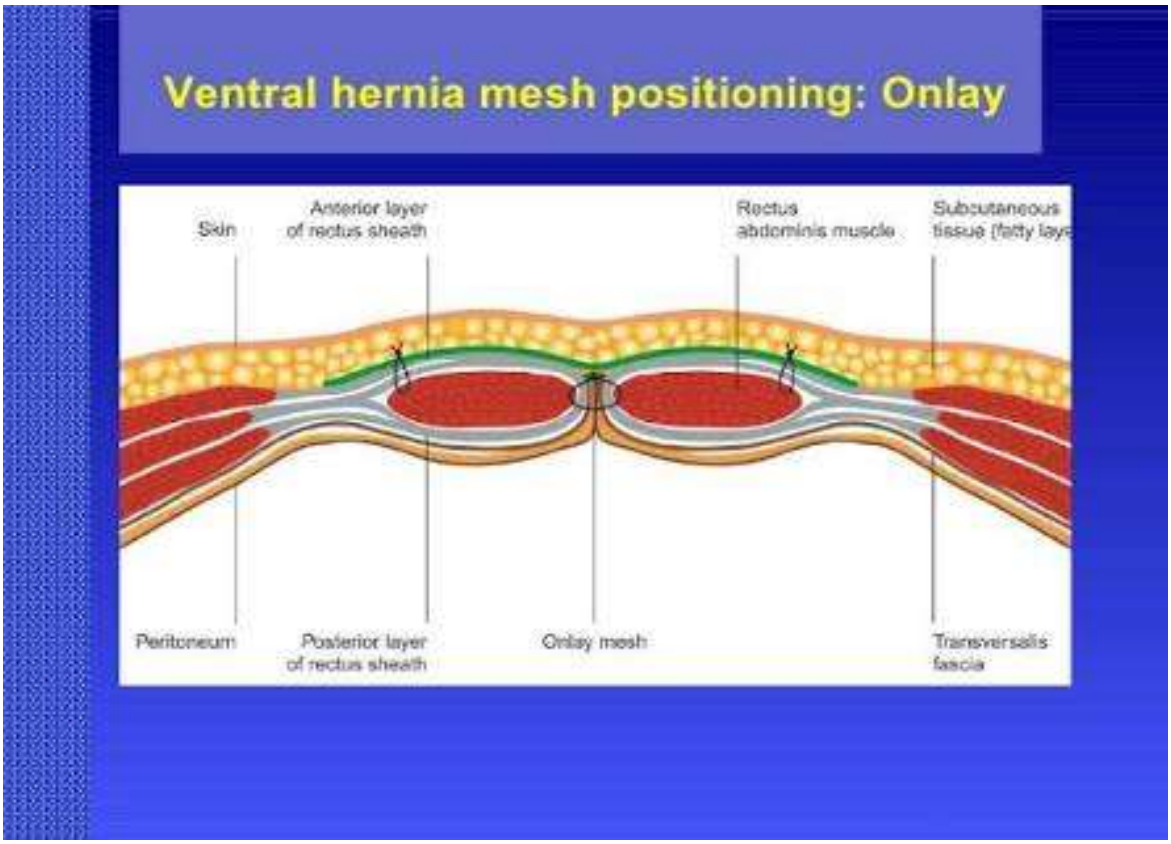


Fig.18: Onlay mesh placement over the anterior rectus sheath

Parameters to be assessed:

Table.1

Paramaters	**Transverse abdominis release (TAR) – Sublay mesh repair**	**Onlay mesh repair**
Wound complications **1. Seroma / wound discharge** **2. Wound gaping** **3. Flap necrosis**		
IntraAbdominal pressure		
Duration of hospital stay		
Quality of life (using carolinas comfort scale)		
Recurrence (period of 1 year)		

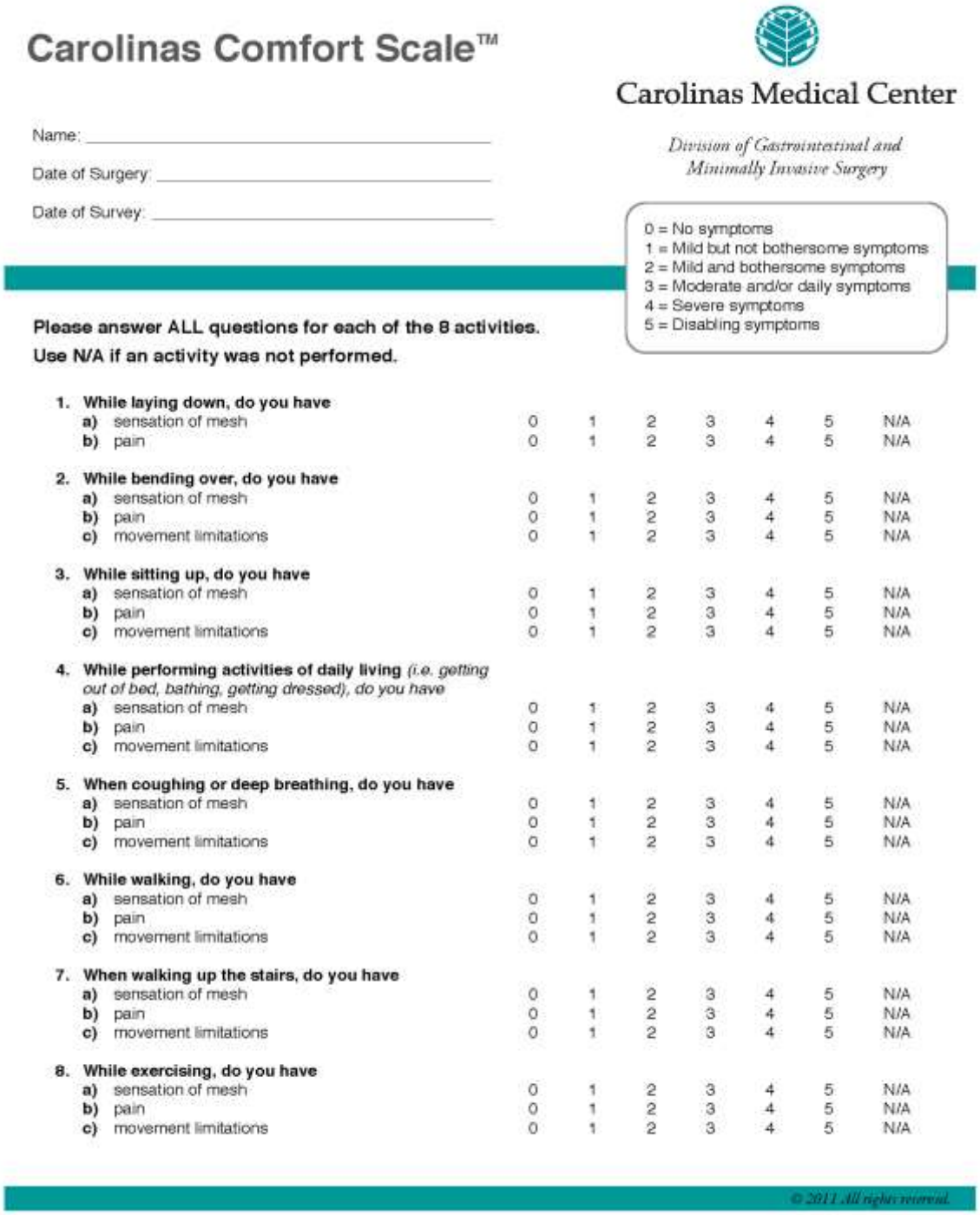
INTRA ABDOMINAL PRESSURE:

- Increased IAP in the postoperative period can serve as an early indicator of postoperative morbidity.
- Optimization of intra-abdominal pressure in the postoperative period thereby can prevent rectus dehiscence, have a positive effect on wound healing, thereby improving the outcome.
- Normal range 5-7 mmHg in critically ill patients
- Intra Abdominal hypertension (IAH) – sustained or repeated pathological elevation of IAP ≥ 12 mmHg
- Reference standard for intermittent IAP measurements is via bladder with maximal instillation of 25 ml of sterile saline

Fig.19: Measurement of IAP - Saline manometer technique

Quality of life :

- Assessed using carolinas comfort scale
- The Carolinas Comfort Scale (CCS) is a validated, disease-specific, quality of life (QOL) questionnaire developed for patients undergoing hernia repair.



Carolinas Comfort Scale™

Carolinas Medical Center

Division of Gastrointestinal and Minimally Invasive Surgery

Name: _____

Date of Surgery: _____

Date of Survey: _____

0 = No symptoms
1 = Mild but not bothersome symptoms
2 = Mild and bothersome symptoms
3 = Moderate and/or daily symptoms
4 = Severe symptoms
5 = Disabling symptoms

Please answer ALL questions for each of the 8 activities.
Use N/A if an activity was not performed.

1. While laying down, do you have							
a) sensation of mesh	0	1	2	3	4	5	N/A
b) pain	0	1	2	3	4	5	N/A
2. While bending over, do you have							
a) sensation of mesh	0	1	2	3	4	5	N/A
b) pain	0	1	2	3	4	5	N/A
c) movement limitations	0	1	2	3	4	5	N/A
3. While sitting up, do you have							
a) sensation of mesh	0	1	2	3	4	5	N/A
b) pain	0	1	2	3	4	5	N/A
c) movement limitations	0	1	2	3	4	5	N/A
4. While performing activities of daily living *(i.e. getting out of bed, bathing, getting dressed), do you have*							
a) sensation of mesh	0	1	2	3	4	5	N/A
b) pain	0	1	2	3	4	5	N/A
c) movement limitations	0	1	2	3	4	5	N/A
5. When coughing or deep breathing, do you have							
a) sensation of mesh	0	1	2	3	4	5	N/A
b) pain	0	1	2	3	4	5	N/A
c) movement limitations	0	1	2	3	4	5	N/A
6. While walking, do you have							
a) sensation of mesh	0	1	2	3	4	5	N/A
b) pain	0	1	2	3	4	5	N/A
c) movement limitations	0	1	2	3	4	5	N/A
7. When walking up the stairs, do you have							
a) sensation of mesh	0	1	2	3	4	5	N/A
b) pain	0	1	2	3	4	5	N/A
c) movement limitations	0	1	2	3	4	5	N/A
8. While exercising, do you have							
a) sensation of mesh	0	1	2	3	4	5	N/A
b) pain	0	1	2	3	4	5	N/A
c) movement limitations	0	1	2	3	4	5	N/A

Fig.20: Carolinas comfort scale

Conclusions:

Hernias with loss of domain present the most challenge to the general surgeon. Treatment of these patients requires a thorough understanding of the patients' abdominal wall anatomy, a meticulous preparation for surgery, and a complete armamentarium of adjunctive maneuvers and repair techniques available to ensure a safe and effective hernia repair.

MATERIALS AND METHODS

1. TITLE : "Comparative study of Posterior component separation technique – Transverse Abdominis Release in large incisional hernias with Onlay Mesh Repair"

2. DESIGN OF STUDY : PROSPECTIVE (case control) STUDY

3. PERIOD OF STUDY : 1 year

4. COLLABORATING DEPARTMENT : nil

5. SELECTION OF STUDY SUBJECTS :

All surgical in-patients of Govt. Rajaji Hospital during the study period satisfying the inclusion criteria were recruited for the study after obtaining valid consent.

6. SAMPLE SIZE :

40 patients were enrolled for the study after obtaining proper informed consent. The patients were randomly allotted to case and control groups.

Total sample size (n) = 40

No. Of Cases = 20

No. Of controls = 20

No. Of dropouts = NIL

7. DATA COLLECTION :

- Patients presenting with large incisional hernia under the study group were subjected to PCS-TAR using standard technique and compared with Conventional Onlay mesh Repair and the following parameters were analysed.

- Wound complications (seroma, wound discharge / gaping, flap necrosis)

  Intra-abdominal pressure,

  Duration of hospital stay,

  Quality of life,

  Recurrence rate

8. METHODS : NON RANDOMIZED

9. ETHICAL CLEARANCE : OBTAINED

10. CONSENT : Informed and written consent from all Patients

11.CONFLICT OF INTEREST : None

12.FINANCIAL SUPPORT : NIL FROM THE INSTITUTION

13.PARTICIPANTS : Patients from surgical OPD or casualty presenting with large incisional hernia in GRH Madurai.

14.FOLLOW UP : Upto 1 year

14.INCLUSION CRITERIA:

- ✓ any patient with large abdominal wall incisional or ventral hernia (defects larger than 10 cm in width, loss of domain);
- ✓ recurrent incisional hernias after intra-abdominal mesh plasty;
- ✓ recurrences after anterior component separation;
- ✓ 4.Patients consented for inclusion in the study according to designated proforma

15.EXCLUSION CRITERIA:

- ∗ BMI > 40
- ∗ Recurrent hernia after Rives- stoppa repair
- ∗ Non ventral hernias
- ∗ Patients not consented for inclusion in the study

16.STATISTICAL ANALYSIS :

The data were analysed using statistical software SPSS ver. 20.0, Microsoft Excel 2010.

Chi Square test was used to analyse the correlation between the incidence of complications in cases and controls. Also individual complications were assessed and p-value for each of them was computed.

p-value of 0.05 is significant.

RESULTS

AGE DISTRIBUTION:

The following table shows the age distribution between cases and controls

Table 2. Age distribution

AGE	CASE		CONTROL	
	Nos	**%**	**Nos**	**%**
≤40	4	20	4	20
41 - 50	6	30	8	40
51 - 60	7	35	5	25
>60	3	15	3	15
TOTAL	20	100	20	100
Mean	49.55		48.95	
SD	10.154		9.875	
P'value	0.851 Not significant			

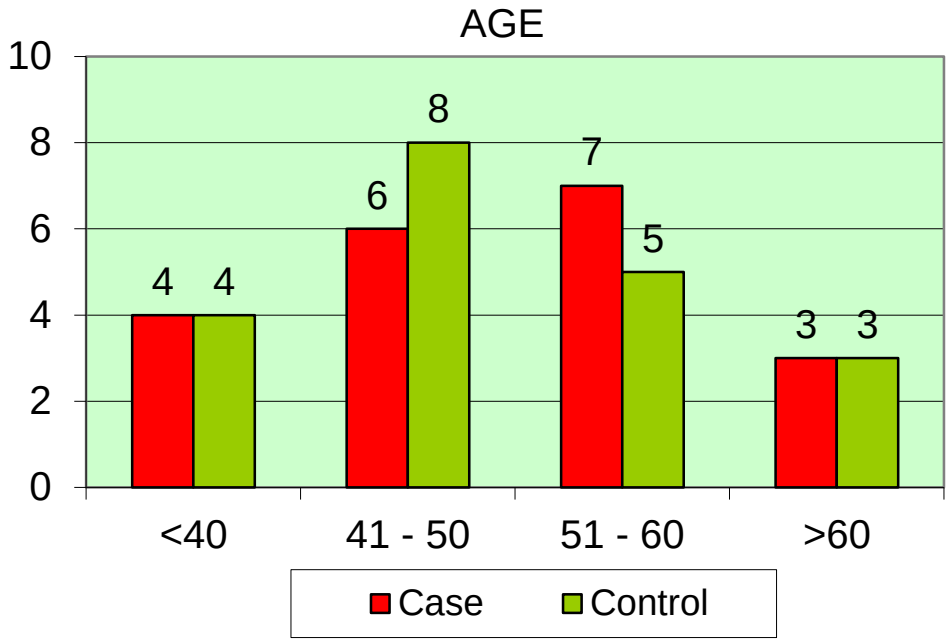


Fig.21: Age distribution

GENDER DISTRIBUTION:

The following table shows the sex distribution between cases and controls

Table 3. Sex distribution

SEX	CASE		CONTROL	
	Nos	**%**	**Nos**	**%**
MALE	3	15	4	20
FEMALE	17	85	16	80
TOTAL	20	100	20	100
P'value	1 .0 Not significant			

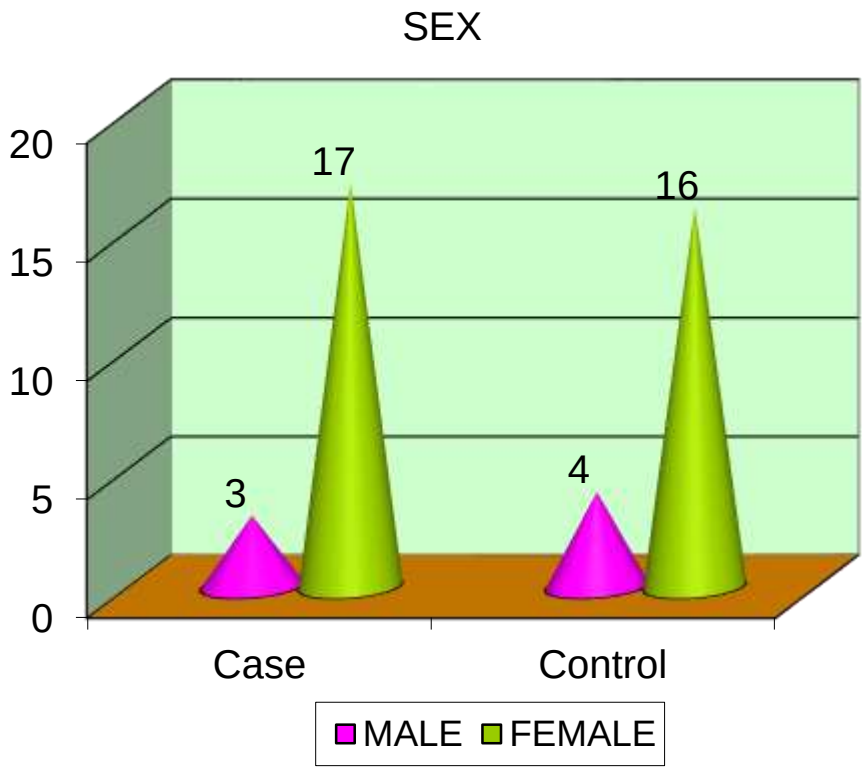


Fig. 22: Sex distribution

The following table shows the duration of surgery between cases and controls

Table 4. Duration of surgery among cases and controls

DURATION OF SURGERY (MINS)	CASE		CONTROL	
	Nos	%	Nos	%
≤100	1	5	17	85
>100	19	95	3	15
TOTAL	20	100	20	100
Mean	122.00		95.25	
SD	18.020		5.955	
P'value	<0.001 Significant			

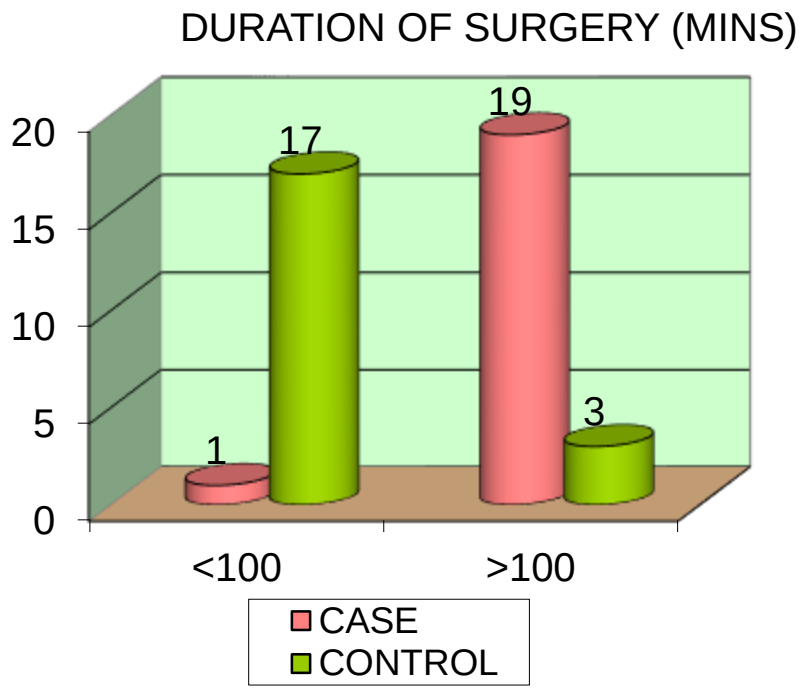


Fig.23: Duration of surgery among cases and controls

The following table shows prevalence of co-morbidity in cases and controls

Table 5.prevalence of co-morbidity between cases and controls

COMORBIDITY	CASE		CONTROL	
	Nos	%	Nos	%
DIABETIC	7	35	5	25
HTN	1	5	2	10
DIABETIC/HTN	0	0	1	5
-	12	60	12	60
TOTAL	20	100	20	100
P'value	0.644 Not Sig			

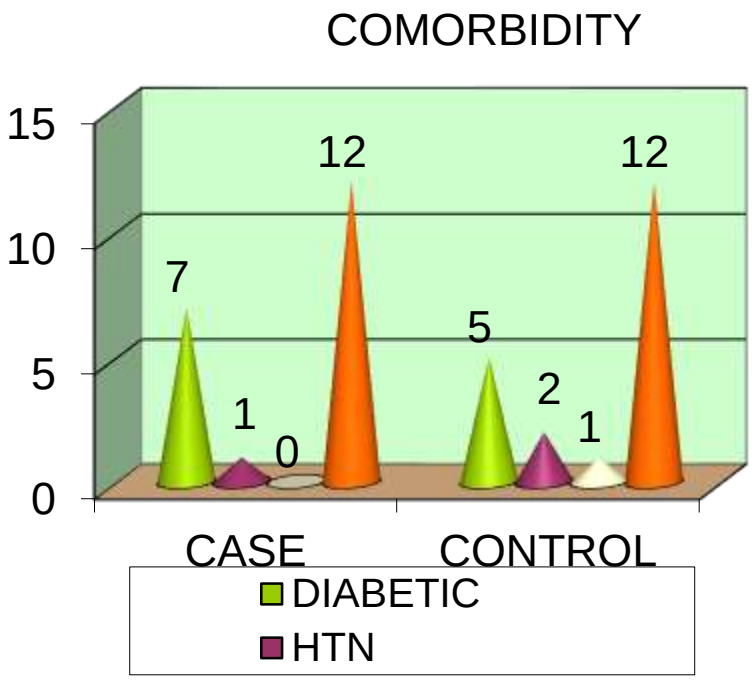


Fig.24: Prevalence of co-morbidity between cases and controls

The following table compares the Defect size between cases and controls

Table 6.comparison of Defect size between cases and controls

DEFECT SIZE (CM)	CASE		CONTROL	
	Nos	**%**	**Nos**	**%**
10	8	40	5	25
11	4	20	5	25
12	6	30	5	25
13	1	5	3	15
14	1	5	1	5
15	0	0	1	5
TOTAL	20	100	20	100
P'value	0.716 Not sig			

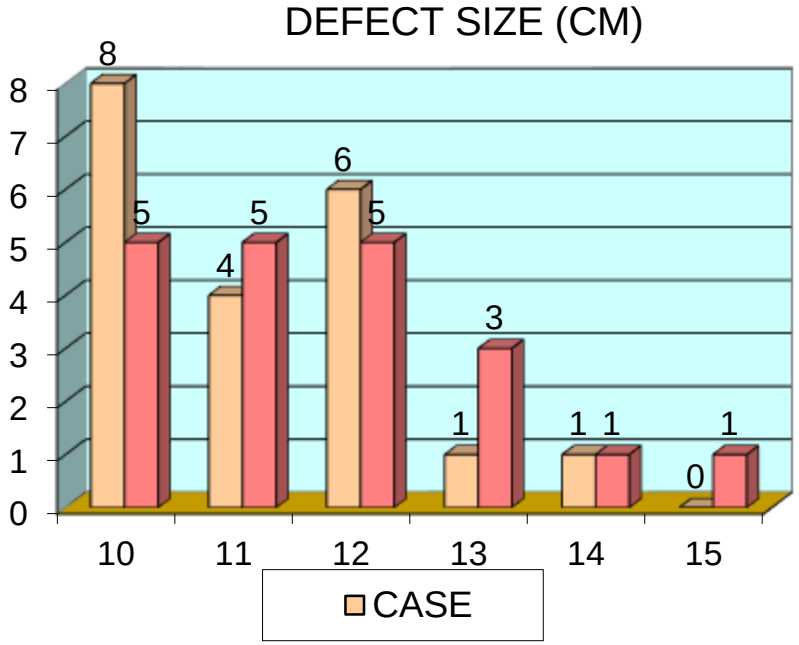


Fig.25: comparison of Defect size between cases and controls

The following table shows the rate of wound discharge between cases and controls

Table 7. Rate of wound discharge between cases and controls

WOUND DISCHARGE	CASE		CONTROL	
	Nos	**%**	**Nos**	**%**
POSITIVE(+)	8	40	9	45
NEGATIVE(-)	12	60	11	55
TOTAL	20	100	20	100
P'value	1.0 Not significant			

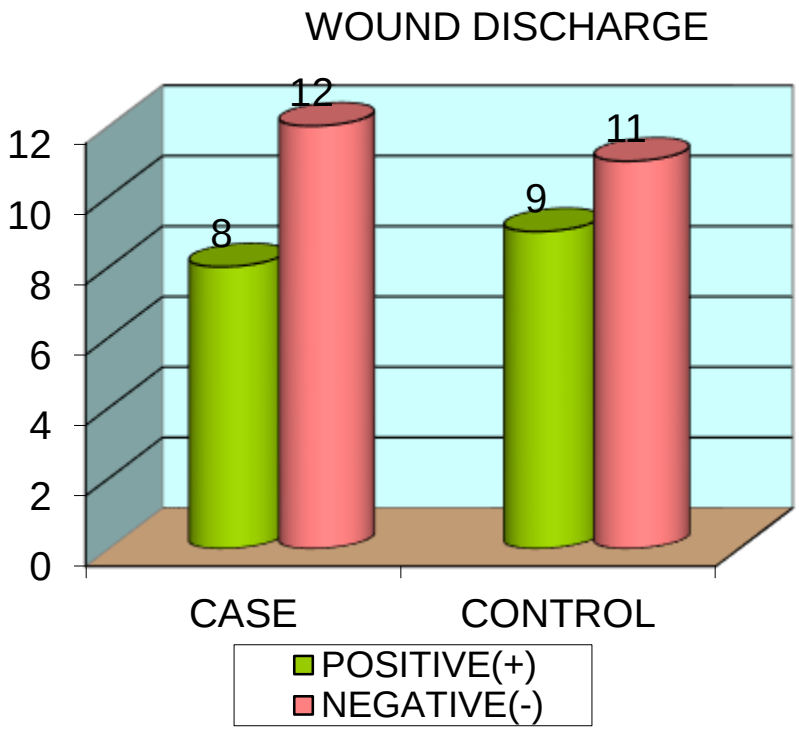


Fig.26: Rate of wound discharge between cases and controls

The following table shows the rate of wound gaping between cases and controls:

Table 8. Rate of wound gaping between cases and controls

WOUND GAPING	CASE		CONTROL	
	Nos	%	Nos	%
POSITIVE(+)	4	20	7	35
NEGATIVE(NO)	16	80	13	65
TOTAL	20	100	20	100
P'value	0.479 Not significant			

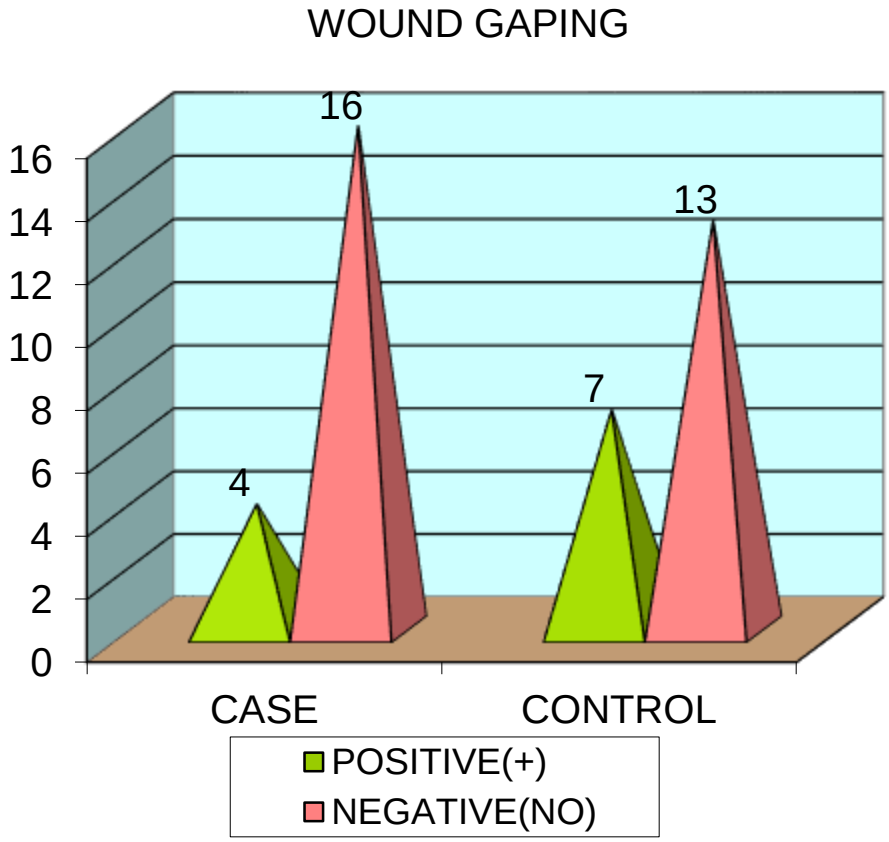


Fig.27: Rate of wound gaping between cases and controls

The following table shows the rate of Flap necrosis between cases and controls :

Table 9. Rate of Flap necrosis between cases and controls

FLAP NECROSIS	**CASE**		**CONTROL**	
	Nos	**%**	**Nos**	**%**
POSITIVE(+)	0	0	6	30
NEGATIVE(NO)	20	100	14	70
TOTAL	20	100	20	100
P'value	0.02 significant			

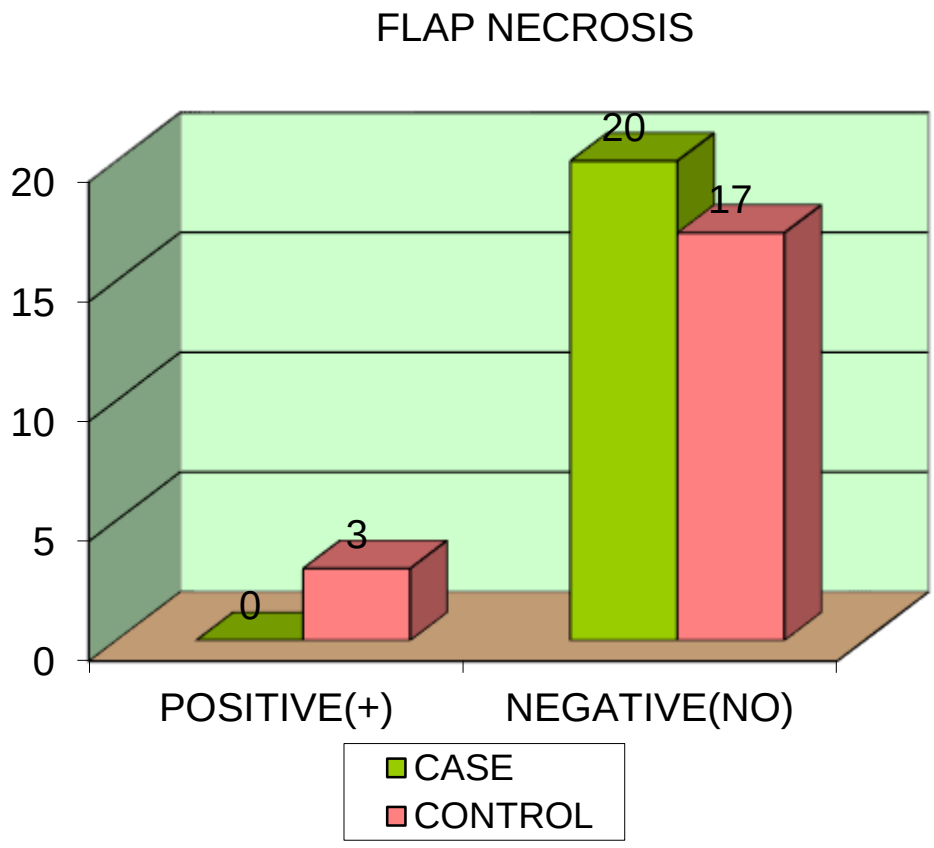


Fig.28: Rate of Flap necrosis between cases and controls

The following table shows the rate of Flap necrosis between cases and controls :

Table 10. Rate of Flap necrosis between cases and controls

DEBRIDEMENT NEEDED	CASE		CONTROL	
	Nos	**%**	**Nos**	**%**
POSITIVE(+)	0	0	6	30
NEGATIVE(NO)	20	100	14	70
TOTAL	20	100	20	100
P'value	0.02 Significant			

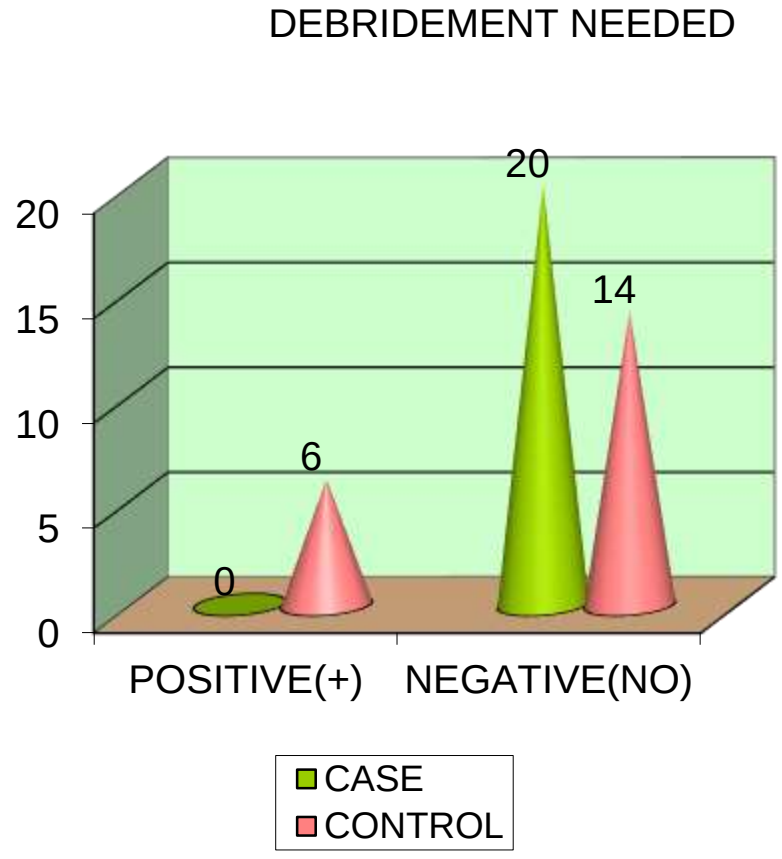


Fig.29: Rate of Flap necrosis between cases and controls

The following table shows the relationship of IAP between cases and controls

Table.11. Relationship of IAP between cases and controls

INTRA-ABDOMINAL PRESSURE	**CASE**		**CONTROL**	
	Nos	**%**	**Nos**	**%**
≤9	18	90	8	40
>10	2	10	12	60
TOTAL	20	100	20	100
Mean	7.25		9.95	
SD	1.333		1.669	
P'value	<0.001 significant			

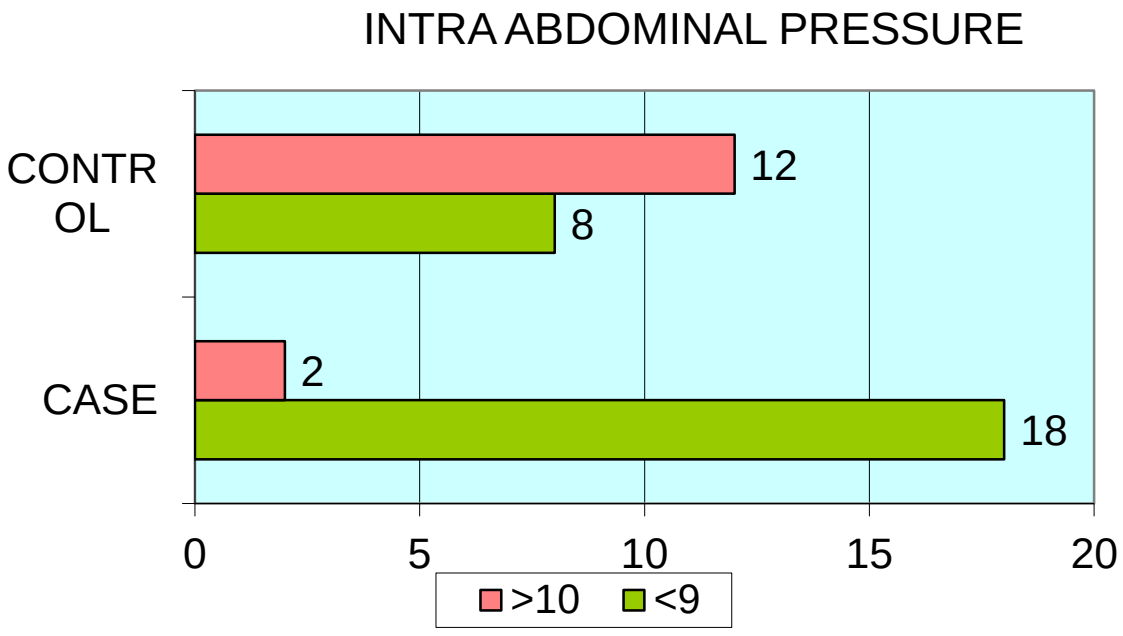


Fig.30: Relationship of IAP between cases and controls

The following table shows the pain score between cases and controls

Table.12: Pain score between cases and controls

PAIN SCORE	CASE		CONTROL	
	Nos	%	Nos	%
<30	9	45	2	10
30 - 40	7	35	5	25
>40	4	20	13	65
TOTAL	20	100	20	100
Mean	31.15		48.05	
SD	8.381		15.511	
P'value	<0.001 significant			

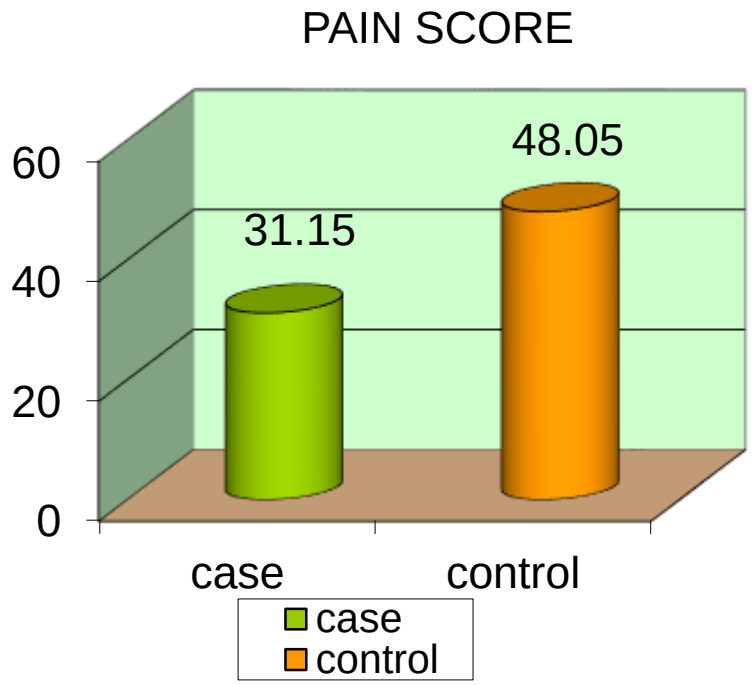


Fig.31: Pain score between cases and controls

The following table shows the duration of post op Hospital stay between cases and controls:

Table. 13. Duration of Post-op Hospital stay between cases and controls

DURATION OF POST OP HOSPITAL STAY (DAYS)	CASE		CONTROL	
	Nos	**%**	**Nos**	**%**
≤10	8	40	4	20
11 - 14	10	50	13	65
>14	2	10	3	15
TOTAL	20	100	20	100
Mean	11.20		12.65	
SD	1.989		1.95	
P'value	0.025 Significant			

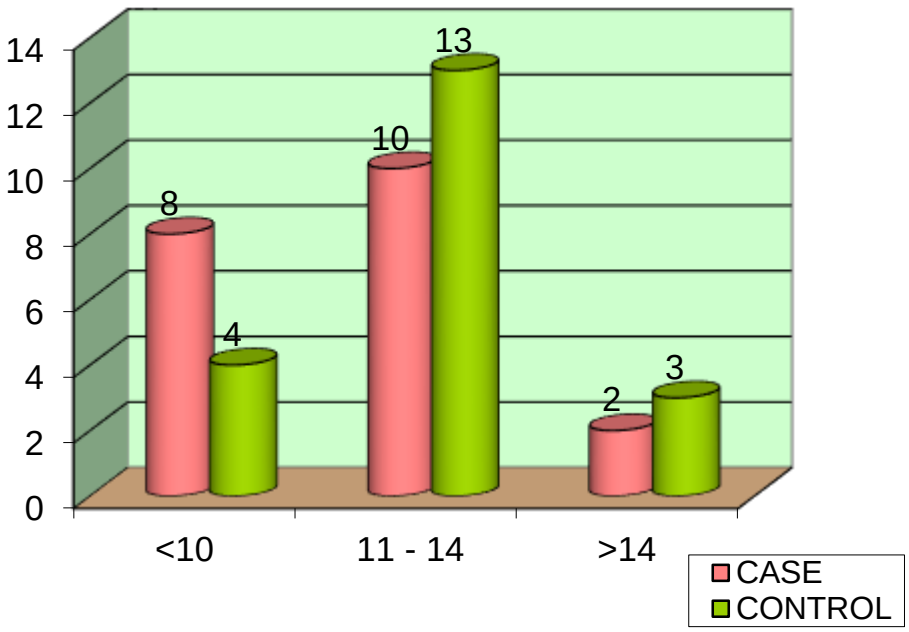


Fig.32: Duration of Post-op Hospital stay between cases and controls

The following table shows the recurrence rate between cases and controls

Table.14. Recurrence rate between cases and controls

RECURRENCE	CASE		CONTROL	
	Nos	%	Nos	%
POSITIVE(+)	1	5	2	10
NEGATIVE(NO)	19	95	18	90
TOTAL	20	100	20	100
P'value	1.0 Not significant			

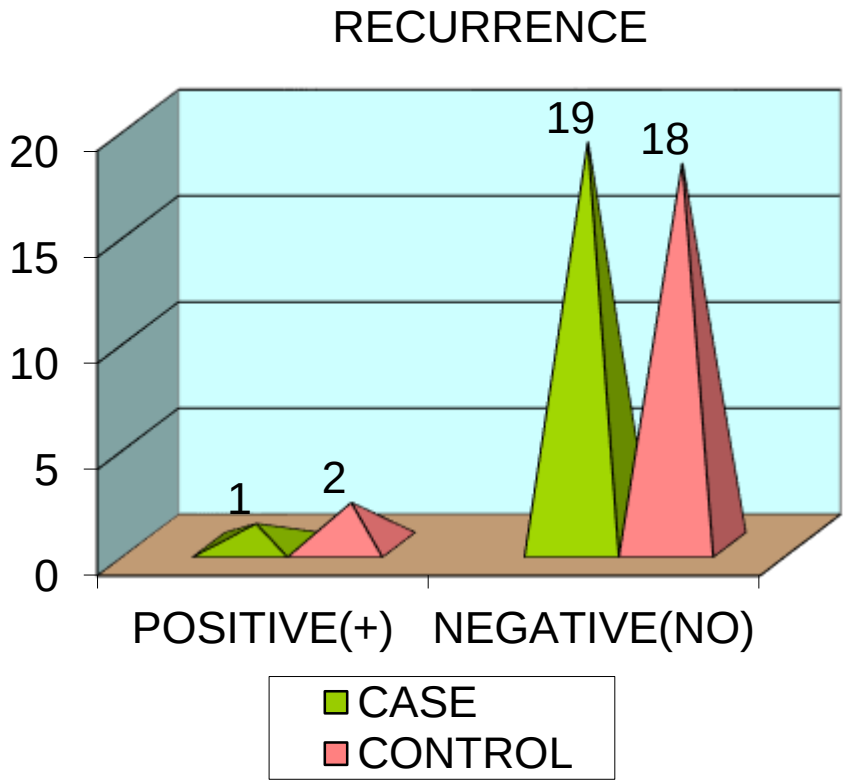


Fig.33: Recurrence rate between cases and controls

DISCUSSION

Incisional hernias are the most common complication after laparotomy and the most common indication for reoperation after laparotomy. Recent advancements in mesh technology and technical refinements in the methods of herniorraphy have dramatically changed the way open hernia surgery is conducted.

Still , the traditional methods of hernia repair have unacceptably high recurrence rates. In this study, we address the posterior component separation, a medial fascial advancement technique to aid in abdominal wall reconstruction for huge incisional hernias.

The factors assessed were

- **hernia defect closure,**
- **abdominal wall reconstruction**
- **post operative outcome**

The details of the patient and the nature of surgery were recorded for all the subjects of the study. The patients were randomly assigned into case and control groups and the pre-operative, intra-operative and post-operative findings were noted.

Table. 15: Correlation of pre-op and per-op factors and its significance

Paramaters	TAR	Open mesh repair	p value
Age	49.55	48.95	0.851
Sex			
male	3	4	1.0
female	17	16	
Comorbidity (DM / HTN /cardiac)			0.644
Positive	8	8	
Negative	12	12	
Duration of surgery	122.00 mins	95.25 mins	**<0.001 significant**

The statistical analysis shows that the case and control groups are comparable in terms of age and gender. The duration of surgery found to be significantly more in doing PCS-TAR because of meticulous dissection.

Table.16: Correlation of post-op factors in cases and controls

Parameters	TAR (no. of cases)	Onlay mesh repair (no. of cases)	p value
Wound complications			
• Wound discharge	8	9	1.0
• Wound gaping	4	7	0.479
• Flap necrosis	0	3	0.02 (significant)
• Debridement	0	6	0.02 (significant)
Intra-abdominal pressure			< 0.001 (significant)
≤ 9 mm Hg	18	8	
> 10 mm Hg	2	12	
Pain score (Mean)	31.15	48.05	< 0.001 (significant)
Duartion of hospital stay	11.20 days	12.65	0.025 (significant)
Recurrence	1	1	1.0
Mortality	Nil	Nil	

The statistics shows that there is no significant difference in the wound complications when comparing wound discharge and gaping whereas there is statistically significant difference in terms of wound debridement and flap necrosis rate in PCS-TAR. The IAP, Pain score and duration of post-op hospital stay found to be much less in PCS-TAR which indicates there is definite benefit of doing PCS-TAR in huge incisional hernias. There is no significant difference in terms of recurrence rate from our analysis.

LIMITATIONS OF THE STUDY:

- The sample size is comparatively small because of the rarity of study subjects.
- The duration of follow up is limited to 1 year.

COMPARITIVE ANALYSIS:

Study	n (no. of cases)	Method	Wound complication %	Mean follow up (months)	Recurrence rate %
Our study	20	Posterior component + TAR	16%	12	5
Novitsky et al. 2012	42	Posterior component with TAR	23.8%	26.1	4.7
Israelsson et al, 2006	228	Sublay mesh	-	12-24	7.3
Carbonell et al, 2008	20	Posterior component, intramuscular	15	12	5
Iqbal et al, 2007	254	Retrorectus dissection	31	53	7

CONCLUSION

This is a comparative study to analyse the effect of PCS-TAR in large incisional hernia and its outcome. The study comprised totally 40 subjects and was carried out over a period of one year and the following advantages were observed in the reconstruction of complex defects.

1. the retro-rectus space is an easily dissected potential space;

2. it is a well vascularized compartment with a more efficient collagen deposition and mesh integration;

3. Posterior component separation results in significant reduction in

- Flap necrosis
- Wound debridement
- Intra-abdominal pressure
- Quality of life
- Post op hospital stay

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PROFORMA

STUDY : "Comparative study of Posterior component separation technique – Transverse Abdominis Release in large incisional hernias with Onlay Mesh Repair"

Name : **IP No:**

Age/Sex : **BMI :**

Occupation:

Address :

DOA : **DOS:** **DOD :**

DIAGNOSIS :

Clinical examination:

H/o surgeries :

Pre-op investigations:

Intra-abdominal pressure: Pre-op: **Post-op:**

Risk factors :

COPD / Asthma	Smoking	Diabetes	Obesity	Nutritional status	CAD	Others

Defect size :

Mesh used:

Duration of surgery :

Complications :

	Immediate	2 weeks	2 months	6 months	1 year
Wound infections					
Pain					
Pulmonary complications					
GI complications					
Recurrence					
Mortality					

Remarks :

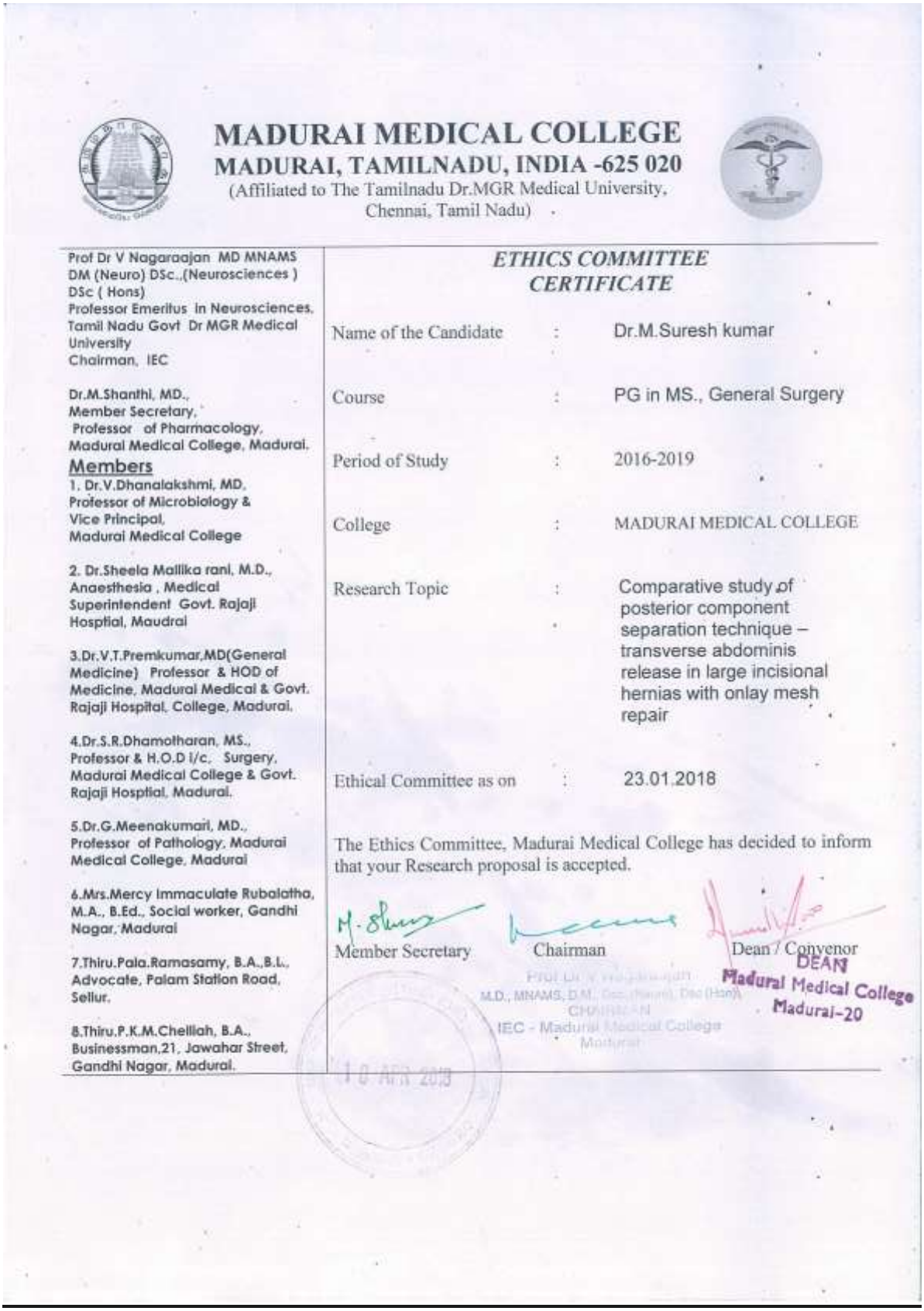
MASTER CHART -CASES

S.NO	NAME	AGE	SEX	COMORBIDITY	DEFECT SIZE (CM)	DURATION OF SURGERY (MINS)	WOUND DISCHARGE	WOUND GAPING	FLAP NECROSIS	DEBRIDEMENT NEEDED	INTRA-ABDOMINAL PRESSURE	PAIN SCORE	DURATION OF POST OP HOSPITAL STAY (DAYS)	RECURRENCE	MORTALITY
															-
1	GLORY	61	F	DIABETIC	11*10	160	+	NO	NO	-	8	32	12	-	-
2	SHANTHA	46	F	HTN	12*12	170	+	NO	NO	-	8	25	11	-	-
3	RAJANGAM	43	M	-	10*12	145	-	NO	NO	-	7	36	10	-	-
4	PANCHAVARNA LAKSHMI	56	F	-	10*10	130	-	NO	NO	-	6	42	8	-	-
5	INDHRANI	48	F	DIABETIC	12*10	135	-	NO	NO	-	10	40	10	+	-
6	ANGALAMMAL	57	F	-	10*10	110	+	+	NO	-	7	46	13	-	-
7	KAVITHA	32	F	-	12*10	120	-	NO	NO	-	6	26	8	-	-
8	MAHALINGAM	41	M	-	14*12	120	+	+	NO	-	7	32	12	-	-
9	VELAMMAL	65	F	DIABETIC	10*11	110	-	NO	NO	-	6	22	9	-	-
10	RAJA	49	M	-	10*10	115	-	NO	NO	-	7	20	10	-	-
11	MARIAMMAL	42	F	DIABETIC	11*12	110	-	NO	NO	-	7	32	10	-	-
12	REGUDEVI	40	F	-	10*10	115	-	NO	NO	-	8	30	11	-	-
13	DHANAM	60	F	-	12*12	120	+	NO	NO	-	6	28	11	-	-
14	SAVITHRI	40	F	-	13*10	110	-	NO	NO	-	6	26	10	-	-
15	CHINNATHAI	29	F	-	10*10	115	-	NO	NO	-	7	24	12	-	-
16	SILAMBAYEE	53	F	DIABETIC	11*11	120	-	NO	NO	-	7	20	11	-	-
17	OCHAMMAL	55	F	DIABETIC	12*12	120	+	NO	NO	-	8	42	15	-	-
18	DHANABACKIYAM	62	F	-	10*10	110	-	NO	NO	-	5	38	12	-	-
19	MAREESWARI	57	F	-	11*12	100	+	+	NO	-	9	42	14	-	-
20	PETCHIAMMAL	55	F	DIABETIC	12*10	105	+	+	NO	-	10	20	15	-	-

MASTER CHART - CONTROL

S.NO	NAME	AGE	SEX	COMORBIDITY	DEFECT SIZE (CM)	DURATION OF SURGERY (MINS)	WOUND DISCHARGE	WOUND GAPING	FLAP NECROSIS	DEBRIDEMENT NEEDED	INTRA-ABDOMINAL PRESSURE	PAIN SCORE (OUT OF 115)	DURATION OF POST OP HOSPITAL STAY (DAYS)	RECURRENCE	MORTALITY
1	VIJAYA	35	F	-	10*11	95	+	NO	NO	-	12	45	12	-	-
2	ALAMELU	60	F	DIABETIC	12*10	90	-	NO	NO	-	9	39	12	-	-
3	THILAGAVATHY	27	F	-	10*10	95	-	NO	NO	-	10	46	10	-	-
4	PAPATHI	61	F	ABETIC/HT	11*10	105	+	+	+	+	12	70	17	-	-
5	MUTHUMARI	57	F	HTN	14*10	100	-	NO	NO	-	8	40	12	-	-
6	MANIPURA	59	M	-	10*10	90	-	NO	NO	-	10	42	11	-	-
7	PETCHI	50	F	-	12*12	100	-	NO	NO	-	10	38	12	-	-
8	KASIVISHWANATHAN	61	M	DIABETIC	13*12	90	+	+	+	+	14	80	16	+	-
9	SADAYAPILLAI	54	M	-	11*12	85	+	+	NO	+	10	60	12	-	-
10	THANGAMUTHU	64	M	-	10*14	95	-	NO	NO	-	9	52	11	-	-
11	PANDI	48	F	-	11*10	90	-	NO	NO	-	9	42	12	-	-
12	PODHUMPONNU	43	F	DIABETIC	10*10	90	+	+	NO	-	13	68	14	-	-
13	NIRMALA	49	F	-	12*12	100	-	NO	NO	-	10	30	10	-	-
14	SASIKALA	39	F	-	13*10	105	+	+	+	+	10	74	16	+	-
15	SELVARANI	46	F	DIABETIC	12*10	95	-	NO	NO	-	8	36	10	-	-
16	SANKARAMMAL	52	F	HTN	15*11	105	+	NO	NO	-	9	42	12	-	-
17	SUTHAMANI	50	F	-	11*11	90	-	NO	NO	-	8	28	11	-	-
18	RAMALAKSHMI	38	F	-	11*10	90	+	+	NO	+	10	48	13	-	-
19	NAGAMMAL	43	F	-	12*10	95	+	+	NO	+	10	56	14	-	-
20	JOTHILAKSHMI	43	F	DIABETIC	13*12	100	-	NO	NO	-	8	25	10	-	

ETHICAL COMMITTEE CLEARANCE CERTIFICATE



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ETHICS COMMITTEE CERTIFICATE

Name of the Candidate	:	Dr.M.Suresh kumar
Course	:	PG in MS., General Surgery
Period of Study	:	2016-2019
College	:	MADURAI MEDICAL COLLEGE
Research Topic	:	Comparative study of posterior component separation technique – transverse abdominis release in large incisional hernias with onlay mesh repair
Ethical Committee as on	:	23.01.2018

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary Chairman Dean / Convenor

DEAN
Madurai Medical College
Madurai-20

Prof Dr V Nagaraajan
M.D., MNAMS, D.M., Dsc.(Neuro), Dsc (Hon's)
CHAIRMAN
IEC - Madurai Medical College
Madurai

10 APR 2018

ANTI-PLAGIARISM CERTIFICATE

URKUND

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